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Comptroller General of the United States

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REPORT TO THE CONGRESS

Need For Improved Operation And Maintenance Of Municipal Waste Treatment Plants B-166506

Federal Water Quality Administration
Department of the Interior

BY THE COMPTROLLER GENERAL
OF THE UNITED STATES

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SEPT. 1, 1970

UNITED STATES GENERAL ACCOUNTING OFFICE

COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

B-166506

To the President of the Senate and the
Speaker of the House of Representatives

This report presents the results of our examination into the need for improved operation and maintenance of municipal waste treatment plants constructed under grants awarded by the Federal Water Quality Administration, Department of the Interior.

Our review was made pursuant to the Budget and Accounting Act, 1921 (31 U.S.C. 53), and the Accounting and Auditing Act of 1950 (31 U.S.C. 67).

Copies of this report are being sent to the Director, Office of Management and Budget, and to the Secretary of the Interior.

R. F. Keller

Acting Comptroller General
of the United States

Contents

Page

DIGEST 1

CHAPTER

1 INTRODUCTION AND SCOPE OF REVIEW 4
- Construction grant program 4
- Waste treatment processes 5
- Responsibility for plant operation and maintenance 8
- Waste treatment plant operation and maintenance costs 9

2 CONCLUSIONS AND RECOMMENDATIONS 11
- Conclusions 11
- Recommendations 15

3 IMPROVEMENTS NEEDED TO OVERCOME OPERATION AND MAINTENANCE PROBLEMS 16
- Need for guidance in the prevention of operation and maintenance problems 20
  - Need for sufficient number of qualified plant operators 21
  - Increased controls needed over industrial sources of pollution 22
  - Improvements needed in plant design and plant equipment 24
- Need for assistance in improving State detection and correction measures 26
  - Evaluation of the need for FWQA inspections 26
  - Improvements needed in State procedures 28

4 ACTIONS TAKEN BY FWQA AND STATES TO IMPROVE PLANT OPERATION AND MAINTENANCE 34
- Actions by FWQA 34
  - Engineering operations section 34
  - Operation and maintenance program 35
  - Plant-operating manual 39
  - Training 40
- Actions by the States 43
  - Training 43

Page

CHAPTER

Operator certification 44
Inspections 45
Other actions 45

5 FEDERAL AND STATE COMMENTS AND OUR EVALUATIONS 46
Council on Environmental Quality, Executive Office of the President 46
Department of the Interior 46
State water pollution control agencies 47

APPENDIX

I Comparison of estimated annual operation and maintenance costs between various types and sizes of waste treatment plants 53

II Comparison of estimated construction costs with estimated total operation and maintenance costs over the life of the plants, by various types and sizes of waste treatment plants 54

III Operation and maintenance problems identified at selected plants 55

IV Recommendations for minimum personnel, laboratory control and records for municipal waste treatment works by the Conference of State Sanitary Engineers in cooperation with U.S. Department of Health, Education, and Welfare, Public Health Service, 1963 74

V Letter dated March 13, 1970, from the Council on Environmental Quality, Executive Office of the President to the General Accounting Office 85

VI Letter dated April 9, 1970, from the Department of the Interior to the General Accounting Office 86

Page

APPENDIX

VII Letter dated March 26, 1970, from the Indiana Stream Pollution Control Board to the General Accounting Office 89

VIII Letter dated April 7, 1970, from the Kentucky Water Pollution Control Commission to the General Accounting Office 91

IX Letter dated March 20, 1970, from the Montana State Department of Health to the General Accounting Office 94

X Letter dated March 25, 1970, from the Oregon Department of Environmental Quality to the General Accounting Office 96

XI Principal officials of the Department of the Interior responsible for administration of the activities discussed in this report 98

ABBREVIATIONS

BOD	biochemical oxygen demand which is a measure of the strength of sewage in terms of the amount of oxygen required to sustain decomposition of the waste by bacteria
FWQA	Federal Water Quality Administration
GAO	General Accounting Office
HEW	Department of Health, Education, and Welfare
O&M	operation and maintenance

COMPTROLLER GENERAL'S REPORT TO THE CONGRESS

NEED FOR IMPROVED OPERATION AND MAINTENANCE OF MUNICIPAL WASTE TREATMENT PLANTS
Federal Water Quality Administration
Department of the Interior B-166506

DIGEST

WHY THE REVIEW WAS MADE

As of April 30, 1970, Federal grants of about $1.4 billion have been awarded by the Federal Water Quality Administration (Agency) to help State and local governments and interstate commissions construct about 9,600 waste treatment projects. The Agency estimated that local governments were spending between $150 and $200 million a year to operate and maintain waste treatment plants. Because of the substantial amounts of Federal funds which have been spent for constructing municipal waste treatment plants and because of the importance of proper operation and maintenance of the plants to the achievement of the nation's water pollution control goals, the General Accounting Office (GAO) examined into the operation and maintenance of plants located in six States.

FINDINGS AND CONCLUSIONS

Operation and maintenance problems have been widespread for many years and have resulted in inefficient plant operations. A widespread occurrence of these problems was shown to exist during a nationwide study of 1,500 waste treatment plants conducted by the Agency in fiscal years 1963-65 and more currently by GAO's review of 69 selected plants. The Agency's inspection reports available for 54 of the 69 plants showed that operational, mechanical, or structural problems existed at 40 plants. (See p. 16.)

Of the 69 plants, GAO visited 12 plants that appeared to have serious operation and maintenance problems and confirmed that 11 plants had experienced or were experiencing operation and maintenance problems. At one plant a qualified operator was not available and untreated sewage was bypassing the plant. In another, feathers and other wastes from a poultry plant disrupted plant operations and caused the operator to discharge untreated waste into the receiving stream. For a detailed discussion of GAO's findings at each of the 12 plants, see appendix III of this report.

GAO believes that operation and maintenance problems have resulted from a lack of qualified operating personnel, inadequate controls over industrial wastes, and inadequate plant design or lack of adequate equipment. To help ensure the efficient operation and maintenance of waste treatment plants, GAO believes that:

- --The municipalities should provide the personnel, laboratory controls, and records needed for sound plant operations. Of the 69 plants, 59 did not meet fully the minimum provisions for personnel, laboratory controls, or records recommended by the 1963 Conference of State Sanitary Engineers. (See p. 17.)

- --The States should improve their procedures to prevent, detect, and correct plant operation and maintenance problems. State records were inadequate for making a determination of the degree of treatment being achieved at 51 of the 69 plants. (See p. 17.)

- --The Agency should provide additional technical advice and assistance to help States and municipalities. The Agency's plant inspection procedures usually duplicated State inspection and other plant surveillance procedures without significantly complementing them. (See p. 26.)

The Agency and the States have established certain procedures for preventing, detecting, and correcting operation and maintenance problems. However, they have acknowledged a need to further develop such procedures and are considering a number of proposals for improving plant operation and maintenance. (See p. 34.)

In his message on the environment submitted to the Congress on February 10, 1970, the President stated that many plants had been poorly designed and ineffectively operated and that the Secretary of the Interior would require federally assisted waste treatment plants to meet prescribed design, and operation and maintenance standards and to be operated only by State-certified operators. (See p. 15.)

RECOMMENDATIONS OR SUGGESTIONS

The Secretary of the Interior should require the Commissioner, Federal Water Quality Administration, to

- --establish, in cooperation with the States, comprehensive guidelines for use by municipalities, States, and the Agency in determining the provisions necessary for ensuring proper and efficient operation and maintenance of municipal waste treatment plants and

- --gather and disseminate information to help the States identify, develop, and implement more effective procedures for the prevention, detection, and correction of plant operation and maintenance problems.

To avoid duplication of effort, the Agency should discontinue its plant operation and maintenance inspections except for the purpose of periodically evaluating State procedures.

AGENCY ACTIONS AND UNRESOLVED ISSUES

Drafts of this report were submitted to the President's Council on Environmental Quality, the Department of the Interior, and the water pollution control agencies of the six States included in GAO's review.

The Council on Environmental Quality, Executive Office of the President, stated:

> "Your report represents a most thorough effort on an important subject. No matter what level of funds are made available for the construction of new treatment facilities, we cannot achieve our water pollution control goals unless these and existing plants are properly operated and maintained."

The Council expressed the belief that:

> "*** the President's recommendations, coupled with some of the additional recommendations made by the General Accounting Office will help achieve a better investment of Federal, State and local funds and higher levels of water quality."

The Department of the Interior and the State water pollution control agencies agreed, in general, with the findings discussed in the report. The Department stated that the report had made reference to departmental actions under way to improve the operation and maintenance of waste treatment plants and that it was confident that the inspections called for in a proposed amendment to the Code of Federal Regulations (see p. 15) would further strengthen the Commissioner's authority to initiate solutions to operation and maintenance problems. Although the full import of this amendment is not clear at this time, GAO believes that, in general, the proposed amendment and the Agency actions under way that are directed toward improving the operation and maintenance of waste treatment plants are in line with its recommendations.

The comments of the Federal and State agencies and GAO's evaluation are discussed in chapter 5.

MATTERS FOR CONSIDERATION BY THE CONGRESS

Although this report contains no recommendations for legislative actions, it is being submitted to the Congress because of the interest shown by members of the Congress in the nation's water pollution problems.

CHAPTER 1

INTRODUCTION AND SCOPE OF REVIEW

The General Accounting Office has examined into the operation and maintenance (O&M) of selected municipal waste treatment plants which were built under the construction grant program administered by the Federal Water Quality Administration (FWQA), Department of the Interior.

Our review was directed primarily toward (1) examining into the existence, nature, extent, and cause of plant O&M problems and (2) evaluating the actions taken by FWQA, States, and municipalities to provide for proper and efficient operation and maintenance of waste treatment plants.

Our review was conducted at FWQA headquarters in Washington, D.C.; at FWQA regional offices in Atlanta, Georgia; Cincinnati, Ohio; and Portland, Oregon; and at State water pollution control agencies in Georgia, Tennessee, Indiana, Kentucky, Montana, and Oregon. We also visited and conducted detailed reviews at 12 waste treatment plants--two in each of the six States.

We reviewed pertinent legislation and FWQA instructions and examined pertinent documents, reports, records, and files at FWQA headquarters and regional offices and State offices. In addition, we interviewed officials knowledgeable in the field of water pollution control--FWQA headquarters and regional officials, State and municipal officials, plant operators, consulting engineers, and members of professional organizations.

The principal officials of the Department of the Interior responsible for the administration of the activities discussed in this report are listed in appendix XI.

CONSTRUCTION GRANT PROGRAM

The Federal Water Pollution Control Act of 1956, as amended (33 U.S.C. 466), authorizes FWQA to award grants to State, interstate, municipal, and intermunicipal agencies for the construction of necessary treatment works to prevent the discharge of untreated or inadequately treated sewage or other waste into any waters. The act limits the extent of Federal financial assistance to an amount not to exceed 30 to 55 percent of the eligible costs of constructing the facilities, depending upon the fulfillment of certain conditions specified in the act. Eligible construction costs are exclusive of certain costs such as site acquisition.

Municipal waste discharged directly into water or carried by natural runoff into water has historically received much of the attention devoted to water pollution control. From 1957 through April 30, 1970, FWQA, through its construction grant program, awarded grants of about $1.4 billion for the construction of about 9,600 waste treatment projects which have a total estimated eligible cost of $6.4 billion. The act does not authorize grants for the O&M costs of municipal waste treatment plants.

WASTE TREATMENT PROCESSES

The conventional waste treatment process is usually considered to consist of two steps--primary treatment and secondary treatment. Primary treatment involves (1) the removal of suspended and settleable solids by flotation and sedimentation and (2) chlorination of the effluent. Primary treatment plants normally reduce the biochemical oxygen demand (commonly referred to as BOD)[1] by about 35 percent, by removing about 50 percent of the suspended solids and about 90 percent of the settleable solids. When the flow of the receiving stream is high in relation to the quantity of sewage contributed, the primary treatment process is sometimes sufficient to safeguard public health and to prevent the development of nuisance conditions. However, additional treatment is often required, especially in instances when the flow of the receiving stream may be low or when pollution loads are exceptionally high.

Secondary treatment involves the aerobic decomposition[2] of the greater portion of the organic matter left in the effluent after the primary treatment process. Generally, when secondary treatment is required, the main function is to furnish oxygen to support aerobic decomposition of the organic matter which cannot be removed by sedimentation. If properly operated and maintained, secondary plants without high industrial waste concentrations will normally remove from 80 to 95 percent of the total BOD and approximately 85 percent of the suspended solids. The presence of industrial wastes can generally be expected to reduce these removals if the plant is not properly designed and careful control is not continually maintained over the treatment process. In addition, these removals can be significantly reduced if the plant is not properly operated and maintained.

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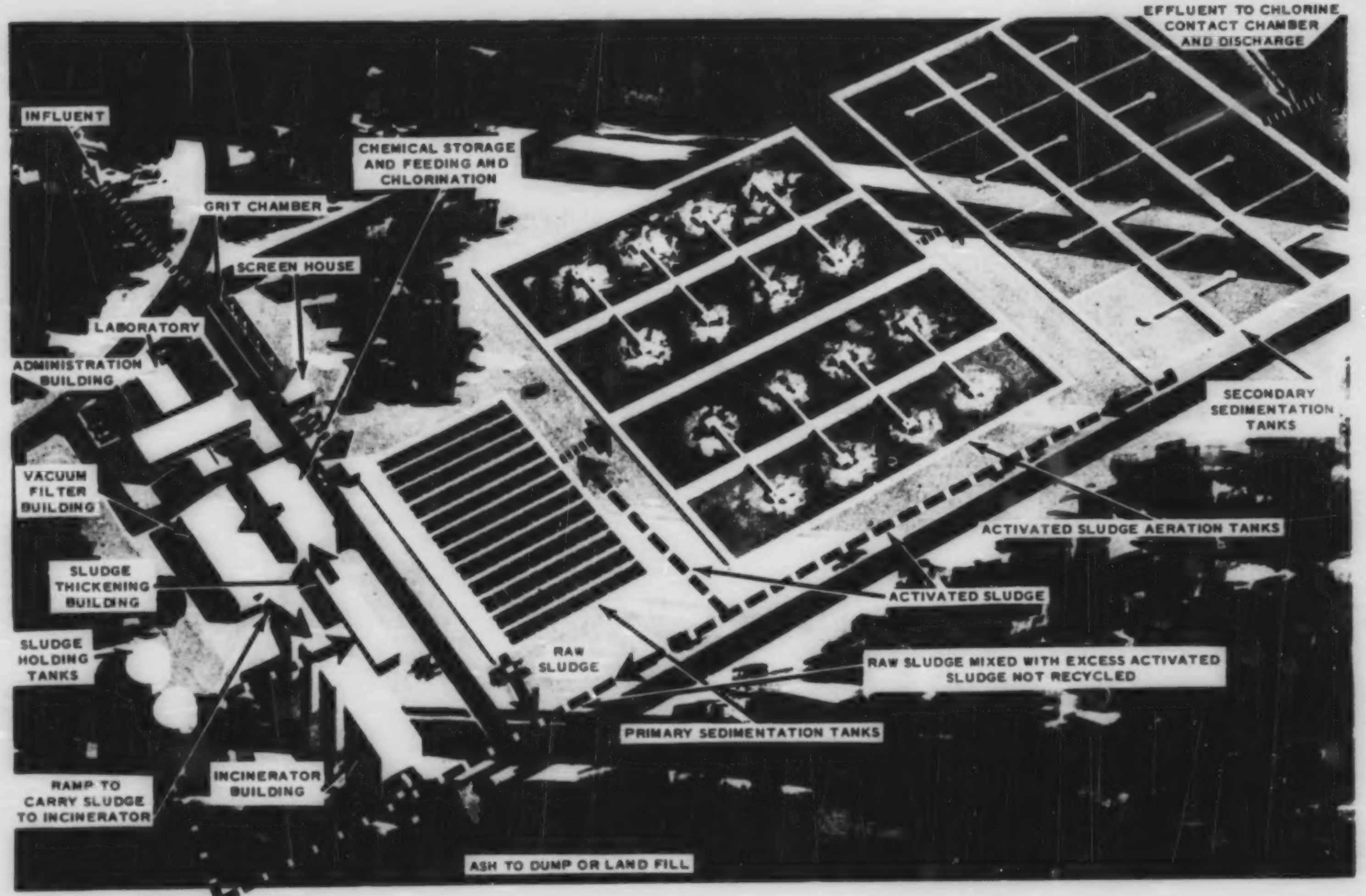
[1] BOD is a measure of the strength of sewage in terms of the amount of oxygen required to sustain decomposition of the waste by bacteria.

[2] Aerobic decomposition is the breakdown of organic matter in sewage by bacteria which grow in an aquatic environment containing dissolved oxygen.

A picture of a secondary treatment plant is shown on the next page.

Tertiary treatment involves a set of chemical and physical processes beyond that of primary and secondary treatment. Although tertiary treatment processes remove substantially all the BOD and suspended solids, they are mainly used for the removal of specific substances, such as phosphates.


INFLUENT
CHEMICAL STORAGE AND FEEDING AND CHLORINATION
GRIT CHAMBER
SCREEN HOUSE
LABORATORY
ADMINISTRATION BUILDING
VACUUM FILTER BUILDING
SLUDGE THICKENING BUILDING
SLUDGE HOLDING TANKS
RAMP TO CARRY SLUDGE TO INCINERATOR
INCINERATOR BUILDING
ASH TO DUMP OR LAND FILL
RAW SLUDGE
PRIMARY SEDIMENTATION TANKS
RAW SLUDGE MIXED WITH EXCESS ACTIVATED SLUDGE NOT RECYCLED
ACTIVATED SLUDGE
ACTIVATED SLUDGE AERATION TANKS
SECONDARY SEDIMENTATION TANKS
EFFLUENT TO CHLORINE CONTACT CHAMBER AND DISCHARGE
= SLUDGE FLOW
= SEWAGE FLOW

SECONDARY TREATMENT PLANT

RESPONSIBILITY FOR PLANT OPERATION AND MAINTENANCE

The Federal Water Pollution Control Act provides that:

> "no grant shall be made for any project *** until the applicant has made provision satisfactory to the Secretary [of the Interior] for assuring proper and efficient operation and maintenance of the treatment works after completion of the construction thereof."
>
> *   *   *   *   *
>
> "In determining the desirability of projects for treatment works and of approving Federal financial aid in connection therewith, consideration shall be given by the Secretary to *** the adequacy of the provisions made or proposed by the applicant for such Federal financial aid for assuring proper and efficient operation and maintenance of the treatment works after completion of the construction thereof."

In addition, the act provides for Federal technical assistance and financial aid to the States and municipalities in the prevention and control of water pollution.

In approving a grant, FWQA relies principally on an applicant's certification that he will satisfy the requirements of the act regarding provisions to be made for plant O&M. After a plant is placed in operation, FWQA generally conducts plant inspections for the purpose of ensuring proper and efficient plant O&M. In addition, FWQA has taken actions to provide training for waste treatment plant operators.

As recognized in the act, the States have the primary responsibility for the prevention and control of water pollution. To meet this responsibility, the States employ certain procedures for the purpose of ensuring proper plant O&M, such as training and certification of plant operators, and plant inspections. The principal procedures employed by each of the six States included in our review are shown in the table below.

State	Operator certification	Operator training	Plant-operating reports	Waste discharge permits	Plant O&M inspections
Oregon	Voluntary	An annual 3-day school; and a 1-night-a-week course for 9 months	Required monthly	Permit system established	Annual
Montana	Mandatory	An annual 5-day school	Requested monthly (annually for lagoons)	Permit system established	Annual
Indiana	Mandatory	An annual 3- or 4-day school; and six annual 1-day schools	Required monthly	No permit system established	At least quarterly
Kentucky	Mandatory	An annual 4-day school; three area courses; and two 1-night-a-week schools for 9 weeks	Required monthly	Permit system established	As needed
Georgia	Voluntary	A semiannual 4-day school; a 1-night course every other week for 3-1/2 months; and a 2-year college course	Submitted voluntarily by a few plants	Permit system established	As needed
Tennessee	Voluntary	Two annual 5-day schools	Required monthly	Permit system established	As needed

Municipalities are primarily responsible for day-to-day plant management and operation by virtue of their ownership of the waste treatment plants. To meet this responsibility, municipalities must generally plan for O&M needs; provide plant personnel, controls, records, and equipment; develop and gather operating data required for their own purposes and those of State agencies; and supervise plant operations.

WASTE TREATMENT PLANT OPERATION AND MAINTENANCE COSTS

The basic cost elements to operate and maintain waste treatment plants are labor, power, spare parts, and chemicals. Labor generally accounts for 50 to 60 percent of the total O&M cost. The amount of each O&M cost element depends on such factors as waste load, degree of treatment, method of treatment, and age and size of plant.

In January 1969 FWQA estimated that local government units in the United States were spending between $150 million and $200 million a year to operate and maintain waste treatment plants. On a per capita basis, the costs amount to about $1.40 for every man, woman, and child being served by waste treatment plants. A comparison of the estimated annual O&M costs between various types and sizes of waste treatment plants is shown in appendix I.

FWQA estimates that Federal participation in the funding of waste treatment plant construction will require about $4 billion for the 4-year period beginning with fiscal year 1971. It can be expected, as a result of future construction of additional waste treatment plants, that the total annual O&M costs will increase. A comparison of estimated construction cost with estimated total O&M costs over the life of the plants by various types and sizes of waste treatment plants is shown in appendix II. The O&M costs represent our projection of estimated O&M costs over the average estimated useful life--25 years--of waste treatment plants.

CHAPTER 2

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Our review of FWQA studies and records of plant inspections and our visits to selected waste treatment plants showed that plant O&M problems were widespread and had resulted in inefficient plant operations. For instance, an FWQA nationwide study of 1,500 waste treatment plants showed that many plants were experiencing O&M problems. Also, our examinations of recent FWQA inspection reports for 54 of the 69 plants which we selected for review, showed that a majority of the plants had experienced operational, mechanical, and/or structural problems. In addition, our visits to 12 of the 69 selected waste treatment plants confirmed that 11 plants had experienced or were experiencing O&M problems. These problems were generally attributable to (1) inadequate numbers of qualified plant-operating personnel, (2) inadequate controls over industrial sources of pollution, and (3) inadequate plant design or equipment deficiencies.

Waste treatment plants must be staffed with an adequate number of qualified personnel to obtain the degree of treatment provided for by the plant design and to conduct necessary maintenance activities. In this regard, a number of individuals knowledgeable in the field of water pollution control--including officials of FWQA, the States, and consulting engineering firms--advised us that a lack of qualified operators was a principal cause of plant O&M problems. We were also informed by municipal officials responsible for the operation of the plants which we visited, where sufficient numbers of qualified operators had not been provided, that a lack of funds prevented the employment of the needed personnel.

Our review showed that municipal waste treatment plants have experienced difficulty treating industrial wastes that have not been pretreated. Often such wastes impair the necessary bacterial action of the treatment facility or reduce the effectiveness of the plant and equipment. In one case, the waste discharged from a meat-processing plant clogged the mechanism of a treatment plant. In another case, feathers and other wastes from a poultry plant disrupted plant operations and caused the operator to discharge raw untreated waste into the receiving stream. In still another case, milk-processing and other wastes that were entering the treatment plant caused an excessive organic load which resulted in inadequately treated effluent. A similar effect occured in another plant when blood and a large amount of other waste discharged from a slaughterhouse entered the sewage system.

FWQA inspection reports showed several instances in which toxic industrial wastes killed the bacteria essential to the secondary treatment process. In addition, we were informed by a State official that one plant was shut down for a period of 9 months in 1968 because toxic wastes had stopped the operation of the sludge digester.

State and municipal officials advised us that either the lack of sewer ordinances regulating the discharge of industrial wastes or the lack of enforcement of such ordinances was the cause of many of the problems with industrial wastes. Officials of several municipalities told us that ordinances concerned with industrial wastes were not enforced because such enforcement might result in losing the industry.

Design deficiences of a waste treatment plant can result in failure to provide for sufficient plant capacity or for the equipment necessary for effective operations. In this regard, our review of FWQA inspection reports showed that difficulties with equipment were a major problem. In addition, O&M problems at seven of the 12 plants which we visited appeared to be attributable, at least in part, to design or equipment deficiencies.

Although we did not evaluate the procedures followed by the various levels of government to ensure that plant design was adequate to provide for proper plant operation, officials of FWQA and of some States stated that they recognized a need for improving the design of waste treatment plants. In addition, an FWQA nationwide study of inspection reports showed that many waste treatment plants had experienced problems because of improper equipment.

To ensure efficient O&M of waste treatment plants, we believe that:

1. Municipalities should provide the personnel, laboratory controls, and records needed for use in ensuring proper plant operations. We found that, of the 69 selected plants, 59 did not fully meet the minimum provisions for personnel, laboratory controls, or records recommended for proper plant operation by the 1963 Conference of State Sanitary Engineers (see app. IV) in cooperation with FWQA's predecessor organization in the Public Health Service.

2. States should improve their procedures to prevent, detect, and correct plant O&M problems. We found that State records were inadequate for making a determination of the degree of treatment being achieved at 51 of the 69 selected plants.

3. FWQA should provide additional comprehensive technical advice and assistance in helping the States and municipalities meet their responsibilities. We have found that FWQA's principal procedure for ensuring proper and efficient plant operation--plant inspections--usually duplicates State inspection and other plant surveillance procedures without significantly complementing them.

FWQA and the States have established certain guidelines and procedures for preventing, detecting, and correcting municipal plant O&M problems and have stated that they recognize a need to further develop such procedures and are considering a number of proposals to improve plant O&M. In this regard, FWQA has stated that it recognizes that the need for effective O&M is becoming increasingly critical and that those efforts which have promise of realizing the most water pollution control for the money at the earliest date should be emphasized.

To increase its assistance to States and local units of government, we believe that FWQA should (1) establish comprehensive guidelines for determining plant O&M needs and (2) help the States improve their procedures for preventing, detecting, and correcting plant O&M problems.

Comprehensive guidelines are needed for determining (1) the number and types of personnel, laboratory controls, and records needed to ensure proper and efficient plant O&M, (2) the education, training, and experience needed by plant-operating personnel, and (3) the potential adverse effects of industrial wastes and possible solutions such as adjustment in plant operation and enactment and enforcement of industrial waste ordinances. FWQA is presently considering the need for improved criteria for plant design. We believe that plant design criteria should also be considered in developing comprehensive guidelines.

In our opinion, the use of such guidelines would enable municipalities to identify and consider O&M needs when planning a waste treatment project and would provide assistance to FWQA and the States in meeting their responsibilities for evaluating the adequacy of municipal O&M planning and plant management. For example, guidelines on the qualifications needed by plant-operating personnel would prove useful in identifying operator training needs before serious O&M problems arise from employing unqualified operators.

We believe that State procedures need improvement in areas such as waste discharge permit systems, reports and analyses of plant operations, and plant inspections. FWQA could be of assistance to the States by gathering and disseminating information to them for the purpose of identifying those procedures which, if properly implemented, would result in improved O&M of waste treatment plants. Such information assembled in a systematic manner may ultimately enable FWQA to develop a model State program for the prevention, detection, and correction of plant O&M problems.

Also, since current FWQA plant O&M inspection procedures usually duplicate State inspection procedures without significantly complementing them, FWQA should discontinue plant inspections except for the purpose of periodically evaluating the State procedures.

RECOMMENDATIONS

We recommend that the Secretary of the Interior require the Commissioner, FWQA, to (1) establish, in cooperation with the States, comprehensive guidelines for use by municipalities, the States, and FWQA in determining the provisions necessary for ensuring proper and efficient operation and maintenance of municipal waste treatment plants and (2) gather and disseminate information to help the States identify, develop, and implement more effective procedures for the prevention, detection, and correction of plant operation and maintenance problems. We recommend also that, to avoid duplication of effort, FWQA discontinue its plant operation and maintenance inspections except for the purpose of periodically evaluating the State procedures.

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The President's message on the environment submitted to the Congress on February 10, 1970, stated that many plants had been poorly designed and ineffectively operated and that the Secretary of the Interior would require federally assisted waste treatment plants to meet prescribed design and operation and maintenance standards and to be operated only by State-certified operators.

In this regard, proposed amendments to the Code of Federal Regulations, published in the Federal Register on March 31, 1970, provide that an applicant for a construction grant assure the Commissioner, FWQA, that pretreatment of possibly harmful industrial wastes will be required and that the State water pollution control agency will inspect the treatment plant at least annually for 3 years after completion of construction and periodically thereafter. In addition, no grant shall be awarded unless the Commissioner determines that the proposed facility is designed to achieve economy, efficiency, and effectiveness in improving the quality of the receiving waterway and that the applicant will meet such requirements as the Commissioner may publish from time to time concerning plant design.

CHAPTER 3

IMPROVEMENTS NEEDED TO OVERCOME OPERATION AND MAINTENANCE PROBLEMS

An FWQA nationwide study indicated that O&M problems at waste treatment plants were widespread as early as 1962. The report on the study, which was published in March 1969, summarized and analyzed the findings related to FWQA inspections of 1,500 waste treatment plants conducted during the period July 1, 1962, through December 31, 1964.

The principal problems reported are shown below.

	Percentage of plants at which problems were reported
Operational problems	8
Mechanical problems	25
Structural problems	8
Odor complaints	19
Bypass of untreated sewage	38

To examine into whether O&M problems had been encountered since 1964, we selected for review 69 plants which were built under Federal construction grant programs in three FWQA regions--Northwest Region, Ohio Basin Region, and Southeast Region. Our selection included plants in six States--Montana and Oregon in the Northwest Region, Indiana and Kentucky in the Ohio Basin Region, and Georgia and Tennessee in the Southeast Region.

In five of the States, we selected 54 plants from FWQA reports of inspections that had been made between January 1, 1967, and December 31, 1968. Because no FWQA inspection reports were available for plants in the sixth State, we selected 15 plants from this State's reports of inspections that had been made during the same period. To the extent possible we selected plants representative of the various sizes and types for which construction grants had been awarded.

As summarized in the following table, FWQA inspection reports for the 54 plants showed that O&M problems similar to those identified in FWQA's nationwide report continued to exist.

	Number of inspection reports	
	Reviewed	Disclosing problems
Operational, mechanical, or structural problems	54	40
Odor complaints	54	20
Sewage bypassing treatment plants	54	28

Also, other types of O&M problems were reported. Of the 69 plants, 59 did not meet fully the minimum provisions for personnel, laboratory controls, or records recommended by the 1963 Conference of State Sanitary Engineers.

Generally the inspection reports did not contain conclusions as to whether the plants were operating so as to attain the degree of treatment provided for by the design of the plants. FWQA officials informed us that BOD test results were frequently used to measure the operational effectiveness of waste treatment plants. Therefore, for the 69 plants, we compared available BOD test results recorded in plant-operating reports submitted to State agencies with engineering design data on plant BOD removal capabilities. Our comparisons were made for a 5-month period which was generally the low or critical streamflow period when the waterways were less capable of absorbing pollution material. For 51 plants, available BOD test and plant design data was not sufficient for us to determine whether the operations of the plants were effective. Of the 18 waste treatment plants for which sufficient data was available, 11 were not operating effectively for all or part of the 5-month period and seven were operating effectively.

FWQA officials advised us that, in a plant designed for 85-percent BOD removal, the achievement of only 70-percent BOD removal as a result of inefficient O&M is not uncommon. When the amount of BOD removed is reduced from 85 to 70 percent during critical streamflow conditions, serious water pollution problems can result since the amount of pollution material reaching the receiving waterway is doubled and the waterway may not be capable of absorbing the material.

To obtain a better understanding of the nature of plant O&M problems, we visited two plants that appeared to have serious O&M problems in each of the six States. We selected 10 plants from FWQA inspection reports which were available for 54 of the plants in five States. Since FWQA inspection reports were not available for the 15 plants selected for review in the sixth State, we visited all 15 plants to gather overall information on their operations and, on the basis of that information, selected two plants to revisit for the purpose of making our detailed review.

Our visits to 11 of the 12 plants showed that a need existed for additional qualified plant-operating personnel, better controls over industrial sources of pollution, and/or improved plant design or plant equipment. (A lack of records prevented us from determining whether the other plant was experiencing O&M problems.) The following table shows the number of plants visited where these needs existed.

	Number of plants
Additional qualified plant-operating personnel needed	7
Better controls over industrial sources of pollution needed	6
Improved plant design or equipment needed	7

Our detailed comments on the conditions noted at each of the 12 plants we visited are presented in appendix III.

On the basis of our visits to the 12 plants and our review of the records pertaining to the 69 plants, we believe that there is a need for FWQA to provide guidance to (1) municipalities for improving their planning for O&M needs and (2) State and Federal levels for evaluating the adequacy of municipal O&M planning efforts. We believe also that FWQA guidance is needed to help the States improve their procedures for preventing, detecting, and correcting plant O&M problems in such areas as waste discharge permit systems, reports and analyses of plant operations, and plant inspections. In this regard, FWQA could be of assistance to States by gathering and disseminating information to the States for the purpose of identifying those procedures which, when properly implemented, would result in improved O&M of waste treatment plants.

NEED FOR GUIDANCE IN THE PREVENTION OF OPERATION AND MAINTENANCE PROBLEMS

FWQA requires that municipal applications for Federal construction grants be submitted to FWQA through State water pollution control agencies. An application is usually accompanied by an engineering report, which describes alternative projects considered and recommends that the preferred project be constructed.

After FWQA has approved an application for a construction grant, the FWQA regional office makes a written offer to the applicant, which is conditional upon the applicant's agreeing to comply with various assurances stated or referred to in the offer, including an assurance, in the form of a certification, that the applicant will properly and efficiently operate and maintain the completed plant. Upon acceptance of FWQA's offer, the applicant is required to submit detailed project plans and specifications to FWQA for review and approval.

Prior to January 1966, applicants for construction grants were required to furnish information in their applications on the annual funds that they planned to provide for labor, chemicals, utilities, and supplies. Since that date applicants have also been required to include a breakdown of the number and types of employees to be hired.

The Director of FWQA's Division of State and Local Programs told us that FWQA had not established guidelines that set forth the specific provisions for O&M which an applicant must make before receiving a construction grant. He told us also that FWQA had relied upon its regional personnel to evaluate each case on its own merits, after giving due consideration to the screening of applications by the State agencies.

With regard to State screening of applications, we found that none of the six States which we visited required applicants to specify the provisions they had made or planned to make for ensuring proper O&M. The States required only that applicants certify that they would properly and efficiently operate and maintain the completed plant.

At the 12 plants which we visited, we discussed with municipal officials the guidance received from FWQA and the States with respect to planning for O&M needs. Most of the municipal officials informed us that neither FWQA nor State officials had provided them with guidance as to the needed personnel, laboratory controls, or records for use in ensuring proper plant operations.

In our opinion, the lack of guidance has contributed to an insufficient number of qualified plant operators, inadequate control over industrial sources of pollution, and inadequate plant design and equipment as discussed below.

Need for sufficient number of qualified plant operators

A frequent cause of O&M problems at waste treatment plants is the lack of a sufficient number of qualified personnel to operate the facilities. Waste treatment plants must be staffed with an adequate number of qualified personnel to achieve the designed level of treatment and maintain and protect the community's investment in the physical plant. Deficiencies in either the quantity or qualifications of the operating staff can adversely affect a plant's operation.

FWQA's report to the Congress entitled "Manpower and Training Needs in Water Pollution Control" (S. Doc. 49, 90th Cong.), dated August 2, 1967, describes waste treatment plant operators as those individuals responsible for the day-to-day operation of waste treatment plants and mechanical equipment such as pumping stations and recording gauges. In small communities an operator may have sole responsibility for the operation of the entire system, whereas in larger cities he is responsible to a professional employee, such as an engineer. The level of education is generally high school, technical or vocational school, or junior college, depending on the size and complexity of the plant.

FWQA's report also states that the skill levels of many waste treatment plant operators are unsatisfactory and that, in many instances, poorly trained and poorly paid personnel are responsible for the operation of costly waste treatment plants. Also, FWQA's 1968 report to the Congress entitled "Cost of Clean Water" attributed many cases of inefficient plant operation to inadequacies of the plant operator or to an insufficient number of plant-operating personnel. In addition, many individuals knowledgeable in the field of waste treatment advised us that a lack of qualified operators was a principal cause of O&M problems.

We made a comparison of the number and types of personnel at the 69 selected plants with the minimum requirements for personnel recommended in the 1963 report of the Conference of State Sanitary Engineers and found that at 18 plants an insufficient number of personnel was being provided and at 30 plants the personnel employed worked an insufficient number of hours. As mentioned on page 18, we found that there was a need for additional qualified plant-operating personnel at seven of the 12 plants which we visited. A number of municipal officials at the plants told us that a lack of funds prevented them from employing the needed personnel.

The conference report, however, presents only limited guidelines for determining the provisions that should be made for plant O&M. The report recognizes that the conference had developed a minimum framework of control procedures and that other factors such as the qualifications of plant-operating personnel also require consideration in making adequate provisions for O&M.

While FWQA has not established guidelines setting forth the qualifications required of plant operators, certain procedures such as procedures for operator training and certification have been established to help ensure that waste treatment plants will be staffed with qualified personnel. These procedures are described in chapter 4.

Increased controls needed over industrial sources of pollution

Our review showed that controls over industrial sources of pollution have not always been adequate to prevent O&M problems from occurring at municipal waste treatment plants. FWQA and State water pollution control agency officials consider industrial wastes to be a major problem in the O&M of municipal waste treatment plants. In our visits to the

12 plants, we noted that six were experiencing problems with industrial wastes. Also, our review of 26 waste treatment plants in two States showed that six of the plants had experienced operation problems because of industrial wastes.

In most municipal plants, industrial wastes are being treated along with domestic wastes. Technical publications explain that this situation may result in overloading of plants in several ways as follows.

The volume of waste contributed by industry may create loads in excess of a plant's capacity and may decrease the detention time in the treatment units, especially in sedimentation basins where the more rapid flow may not permit adequate settling. The usual effect of such overloading is inadequately treated effluent. Settleable solids from industrial wastes may result in overloading various treatment plant components, such as the screens, grit chambers, settling tanks, and sludge-handling mechanisms. Coarse and floating solids such as hair, feathers, and rags are included in certain industrial wastes and cannot be handled by conventional sewage equipment. Oils and greases are troublesome because they cause sludges and floating scums that do not settle, drain, or dry properly.

Many industrial wastes carry a higher BOD load than domestic sewage. Unless such industrial wastes are pretreated before entering the municipal waste treatment plant, overloading of the plant equipment may result. In one such case, milk-processing and other wastes discharged to a waste treatment plant caused an excessive BOD load.

The biological and bacterial action of treatment plant processes may be retarded or stopped entirely by the presence of certain toxic industrial wastes such as heavy-metal salts, cyanides, phenols, formaldehyde, and other chemicals. FWQA inspection reports showed several instances where toxic industrial wastes killed the bacteria essential to the secondary treatment process. In addition, we were informed by a State official that one plant was shut down for a period of 9 months in 1968 because toxic wastes had stopped the operation of the sludge digester.

State and municipal officials advised us that either the lack of ordinances related to industrial wastes or the lack of enforcement of such ordinances was the cause of many of the above problems. Several municipal officials told us that industrial waste ordinances were not enforced because of concern over losing the industries.

Improvements needed in plant design and plant equipment

Our review of FWQA inspection reports for 54 plants showed that equipment difficulties had been experienced at 29 plants. Our visits to the 12 plants also indicated a need for improved plant design as well as for proper equipment at seven plants. At one plant sufficient capacity had not been provided; at four plants other apparent design problems existed; and at two plants equipment necessary for effective operations had not been provided.

At one plant a city official advised us that, although the plant was intended to serve the population in the area for 25 years, consideration had not been given to the population growth which resulted from the construction of an interstate highway through the city and that, after only 3 years of operation, the plant was having an overflow problem. At a second plant, the top of one of the process facilities was constructed at ground level and, during periods of heavy rainfall, the runoff from the surrounding high terrain resulted in flooding of the plant. At another plant, a comminutor for grinding rags and stringy materials in the incoming sewage was not provided. The operator experienced repeated problems because rags and other material continually clogged the pumps.

Generally waste treatment plants are designed by a consulting engineer and the plans and specifications are reviewed by the State water pollution control agency and by FWQA. Although we did not evaluate the procedures followed by the various levels of government to ensure that plant design was adequate to provide for proper plant operation, officials of FWQA and of some of the States acknowledge that a need existed for improvement in the design of waste treatment plants.

FWQA's nationwide study of inspection reports showed that many waste treatment plants had experienced problems with equipment. In addition, FWQA regional officials have stated that improper plant design is one of the principal causes of plant O&M problems. FWQA, in its proposed O&M program (see p. 35), noted that proper design of a waste treatment plant is one of the basic elements needed to achieve effective operation and maintenance.

Officials of two of the States have advised us that design capacity is influenced more by the communities' limited funding capability than by anticipated future demand. One of the State officials said that as a result some plants are obsolete in terms of capacity soon after they are completed.

NEED FOR ASSISTANCE IN IMPROVING STATE DETECTION AND CORRECTION MEASURES

Even when adequate provisions have not been made to prevent the occurrence of O&M problems, the effects of problems that occur can be minimized through procedures available for detecting and correcting improper or inefficient O&M. Existing State procedures, however, are in need of further development. In this regard, FWQA could be of assistance to the States by gathering and disseminating information to develop a model State program for the detection and correction of plant O&M problems.

The more important detection procedures rely heavily upon analyses of laboratory control data developed by plant operators. In our opinion, certain O&M problems have not been corrected because municipal plant operators have not developed the data needed to properly control plant operations, and States have not fully implemented their procedures for detecting O&M problems. Also, FWQA's plant inspections do not significantly assist either the States or the municipalities in ensuring the proper and efficient O&M of waste treatment plants.

An important corrective procedure is the issuance by States of conditional waste discharge permits to municipalities which require that they take corrective actions within a specified period of time. We found, however, that one State had not established a waste discharge permit system and that other States had not fully implemented their permit systems.

Evaluation of the need for FWQA inspections

The FWQA "Handbook of Procedures--Construction Grants Program" requires that FWQA inspections of plants be made about 1 year after the plants have been placed in operation to determine whether they are providing the services for which Federal assistance was granted. We found that FWQA inspection procedures usually duplicate State inspection procedures without significantly complementing them.

Generally, FWQA inspections are one-time visits. In some cases a follow-up inspection is made after 3 years.

FWQA and State officials have informed us that a municipality is usually informed in advance of the date that an inspection is to be made. In addition, a copy of the FWQA inspection form (Sewage Treatment Plant Operation and Maintenance Practices Questionaire) is usually forwarded to the municipality with instructions that the form be completed, to the extent possible, prior to the inspector's visit.

The handbook provides that inspections of plants may be made by a representative of either FWQA or the State. For about 25 percent of those inspections made by State officials, cognizant FWQA regional officials accompanied the State officials.

According to FWQA headquarters records, the following number of plant inspections were made during fiscal years 1968 and 1969.

	Inspections conducted by		
Fiscal year	FWQA	States for FWQA	Total inspections
1968	229	114	343
1969	225	150	375

FWQA officials advised us that they did not account separately for the costs incurred to make the inspections and that any estimate of the costs would be very rough. Estimates which we obtained from an FWQA headquarters official and from officials at the three FWQA regional offices we selected for review indicated that the average cost of an inspection ranged from about $100 to $400.

FWQA officials have informed us that FWQA inspectors, rather than make independent laboratory tests at a plant, usually rely upon the State and the plant test results and records in evaluating plant O&M. (See p. 32 regarding the reliability of these tests.) FWQA Northwest Regional Office officials have stated that, when test results are not available, inspectors rely on visual observation of the equipment, operating records and procedures, housekeeping, influent, sewage as it passes through the plant, effluent, and the receiving waters.

After a plant inspection has been completed, copies of the report are normally sent to the municipality. In those cases where FWQA makes the inspection, the report is routed through the State water pollution control agency. The States are requested to use the reports to call potential or existing problems to the attention of the municipalities. Northwest Regional Office officials informed us that, where major problems were observed, they asked the States to advise them of the corrective action taken but that oftentimes the States did not furnish the requested information.

As previously stated on page 17, the FWQA inspection reports we reviewed often identified O&M problems but generally did not contain conclusions as to whether the plants were operating so as to attain the degree of treatment provided for by the design of the plant. In this regard, FWQA regional office officials told us that most of the inspections had been completed within half a day but, because of the extensive tests that would have to be made and analyzed, as much as 3 weeks could be required to determine whether the plants were operating effectively.

In view of the manner in which the inspections are conducted and the reports are used, we believe that FWQA plant inspection procedures do not provide a full effective means of detecting and correcting plant O&M problems. In addition, each of the six States has established its own separate inspection procedures, although these procedures have not been fully implemented.

Since, by law, the States are primarily responsible for water pollution control and FWQA is authorized to provide financial and technical assistance to the States, we believe that FWQA should (1) place more emphasis on providing assistance to the States in strengthening their inspection procedures and (2) discontinue making inspections except for the purpose of periodically evaluating the State procedures.

Improvements needed in State procedures

The six States included in our review had established or were developing procedures to help detect and correct plant O&M problems. These procedures included (1) issuing waste discharge permits to treatment plants, (2) requiring plant operators to submit periodic reports on plant operations, and (3) inspecting plants. Because our review showed that State procedures needed to be improved, we believe that FWQA should provide guidance and assistance to the States in detecting and correcting O&M problems at waste treatment plants.

Waste discharge permits

Of the six States, five had established waste discharge permit systems. In general, the purposes of the permit systems were to (1) allow municipalities to discharge treated wastes into waterways within the State and (2) communicate to the municipalities the State requirements regarding plant operation. Such requirements involved limitations on the type or quantity of waste to be treated and discharged into the waterways, the standards of waste removal to be achieved, or a general statement that the plant must be operated in accordance with applicable State laws and regulations.

Of the five States, one State issued waste discharge permits to plants before evaluating plant capability to achieve the level of waste removal required by the State. Each of the other four States provided that, prior to the issuance of a waste discharge permit, a determination be made of either a plant's capability to meet the State requirements or the conditions under which the discharge of waste would be permitted. However, some State officials have advised us that, because the States' permit systems are relatively new or because there are staff shortages or fund limitations, they have not been able to fully implement the waste discharge permit systems.

Generally when plant O&M problems are identified which adversely affect a plant's capability to achieve State requirements for waste removal, a conditional permit is issued which requires that necessary corrective action be taken within a specified period of time. In this regard, we found that one State did not always ensure that necessary corrective actions were taken within the permitted periods of time.

Plant-operating reports and laboratory tests

Although the six States either require or request municipalities to submit reports on plant operations, our review showed that (1) the operating reports did not always contain sufficient data to measure the degree of treatment being achieved, (2) many operating reports were not being submitted, and (3) some States did not regularly review the reports which were submitted. In addition, during our plant visits and review of FWQA inspection reports, we found that many plants were not performing the laboratory tests or maintaining the records necessary to meet the minimum recommendations of the Conference of State Sanitary Engineers and that there was some question concerning the reliability of the laboratory test results reported for other plants.

The report format, established by the State agencies, usually provides for the reporting of results of laboratory tests, weather and flow data, cost data, and operator comments regarding matters affecting plant O&M.

State officials advised us that the State agencies might use the reports for such purposes as (1) analyzing stream data, (2) evaluating the advisability of approving requests for a tie-in to a sewer system, and (3) identifying actual or potential problems in plant operation. For example, the results of laboratory tests may indicate whether proper control is being maintained over plant operations and whether the plant is removing from the wastes the required quantity of BOD and solids.

As stated on page 17, we compared BOD test results recorded in plant-operating reports submitted to State agencies with engineering design data on plant BOD removal capabilities for the 69 plants selected for our review. However, incomplete data on either plant design or BOD test results prevented us from determining the degree of treatment being achieved at 51 of the 69 selected plants and the incidence of incomplete data was relatively high in each of the three FWQA regions.

Similarly, a 1969 report on a survey of 95 plants by the FWQA Northwest Region showed that available data was inadequate for determining the effectiveness of 42 of the plants. The Northwest Region's survey was based on plant-operating reports, State survey records, and discussions with State personnel in late 1968. According to the survey report, all plants reviewed in Oregon had submitted operational data of some type to the State but only 62 percent of the plants surveyed in Washington and 27 percent of the plants surveyed in Idaho had submitted such data.

Officials of three States have advised us that they do not regularly review all the reports submitted by plants to the States because of shortages in staff and/or funds.

The report by the Conference of State Sanitary Engineers contains recommendations regarding minimum laboratory controls and records for waste treatment plants. The report stated that adequate laboratory control is the only satisfactory and sure measurement of the degree of treatment being obtained by a plant. The report stated further that accurate and readily understandable records are necessary to (1) facilitate local and State supervision, (2) guide operating personnel in locating and solving operating problems, (3) provide proof of performance, and (4) justify decisions, expenditures, and recommendations.

We examined into whether the minimum laboratory controls and records recommended in the conference report were being maintained at the 69 selected plants by reviewing FWQA reports of plant inspections or by obtaining information from municipal personnel. The following table shows the number of plants which did not fully meet the minimum recommendations for the specific categories covered in the conference report. Certain plants did not meet the conference recommendations in two or more of the categories.

	Number of plants
Laboratory controls:	
Certain tests not performed	45
Tests performed but not at the required frequency	30
Records:	
Incomplete records of operations other than laboratory tests	18
Incomplete records of laboratory tests	17

We noted that the Office of Survey and Review, Department of the Interior, during its audits of construction grants awarded by FWQA, found that, in a number of cases, the plant operators were not making laboratory tests of plant effluent. These deficiencies were reported to FWQA with a recommendation that appropriate local officials be advised that these tests are needed to ensure that the effluent of waste treatment plants meets the State requirements.

The FWQA official who conducted the Northwest Region's survey advised us that he did not test the reliability of the laboratory control data for any of the plants he selected. However, State and consulting firm officials and some treatment plant operators informed us that laboratory control data developed for some plants was often not reliable. Officials of two leading consulting firms estimated that about 75 percent of the plants they reviewed did not have reliable test results. One of these officials explained that many of the plant operators were not adequately trained to make the complex tests required and that municipal budgets were frequently inadequate to finance the needed laboratory equipment. An official of a third consulting firm informed us that, in his opinion, only about 50 percent of the operating reports that he had reviewed in the past 2 to 3 years were reliable.

State officials told us that they were aware that test results were sometimes unreliable. As examples, they stated that one plant operator had been entering flow data on his report even though the flowmeter had been inoperative and that another operator had admitted to falsifying the test results after a State inspector had observed dust on the laboratory equipment.

Some plant-operating personnel also told us that test results were not always correctly recorded. One plant supervisor said that inaccurate test results were reported especially when plants started to experience O&M difficulties. Another plant supervisor, with 33 years of treatment plant experience, estimated that only about two out of five plants reported valid laboratory test results to the State.

Officials of two of the States indicated that generally plant operators needed more training and assistance in performing the required tests and developing reliable reports to make the operating report procedure more effective.

Plant inspections

The plant inspections conducted by each of the six States are in addition to any O&M inspections that the States may perform for FWQA. One State inspects each plant quarterly, two States inspect plants annually, and the remaining three States make inspections on an as needed basis rather than regularly. Officials of one State informed us that regular inspections were not made in the State because of a shortage of personnel and that inspections were made when a need arose as shown by analysis of monthly operating reports, complaints by citizens, or requests from municipalities.

Four of the States also conduct independent laboratory tests to determine the degree of treatment that is being achieved at the plants. However, only two of these States make such tests on a regular basis and those tests are made only at selected plants.

State officials indicated to us that in most cases State inspections, although intended to detect and correct many operating problems, were either not made as frequently as desired or were only of sufficient scope to permit the inspectors to detect and assist in the correction of the more obvious operating problems. State officials advised us that these conditions existed primarily because of limitations on manpower or funds available to the States for making the inspections.

CHAPTER 4

ACTIONS TAKEN BY FWQA AND STATES TO IMPROVE PLANT OPERATION AND MAINTENANCE

As discussed in chapter 3 of this report, there is a need for improved procedures to help ensure the proper and efficient operation and maintenance (O&M) of municipal waste treatment plants. At the time of our field review, FWQA and the States had taken or were considering actions to improve or supplement existing procedures and practices.

Since the actions taken have not been in effect for a sufficient period of time, we did not attempt to evaluate them. A number of proposals have been advanced for improving plant O&M and we believe that those efforts which have promise of realizing the most water pollution control for the money at the earliest date should be emphasized.

ACTIONS BY FWQA

FWQA has established an Engineering Operations Section to deal with O&M matters, has developed a program of actions necessary to improve O&M, has required project consulting engineers to provide plant-operating manuals and on-the-job training for plant employees, and has increased its efforts regarding operator training and manpower requirements.

Engineering Operations Section

Pursuant to a reorganization in October 1968, an Engineering Operations Section was established within FWQA's Division of State and Local Programs. The functions of this section include the evaluation of current criteria and practices for the design, operation, and maintenance of waste treatment plants and the development or promotion of new and improved criteria and practices where needed. FWQA officials told us in February 1970 that additional employees were being assigned to this section and to the regional offices specifically to deal with the O&M aspects of waste treatment plants.

Operation and maintenance program

On November 27, 1968, the Director of FWQA's Division of State and Local Programs sent a proposed O&M program to all regional directors for their review and comment. Subsequent to the receipt of regional comments, revised drafts of the program were prepared in April and June 1969 and a final draft dated January 1, 1970, was submitted to the FWQA regions. The regional offices were requested to initiate meetings with each State water pollution control agency with the objective of establishing appropriate, mutually compatible operation and maintenance programs.

The objective of the O&M program is to protect and enhance water quality by providing the leadership, guidance, and coordination necessary to ensure that waste treatment plants, particularly those constructed with Federal financial support, are being operated and maintained at optimum efficiency. The report on the program states that many plants are apparently operated at levels below the designed optima and, although many of the reasons for the condition are known, it is apparent that a more intensive program must be developed by FWQA to define the improvements needed in O&M, establish priorities, and achieve the desired objectives. The report notes that the task of upgrading O&M is a combined Federal, State, and local responsibility and that the role of FWQA should be primarily to assist the States and local units of government in achieving their objectives through financial, technical, and planning assistance and to otherwise provide assistance the States and local governments are unable to provide.

The report states that the following basic elements must be provided to achieve effective plant O&M.

1. The basic treatment facilities must be appropriately designed.

2. Plant-operating personnel must be adequate in number and sufficiently qualified.

3. There must be appropriate laboratory facilities and personnel.

4. All elements of the facilities must be well managed, including the provision of adequate funds for O&M, and municipal regulations must be provided to ensure necessary control of industrial wastes.

5. Management must provide motivation and incentives to attract, develop, and retain good operating personnel.

The report states also that sanitary districts, counties, and municipalities have primary responsibility for providing adequate facilities and ensuring their effective operation. State governments have primary responsibility for establishing waste treatment standards, design criteria, and other guidelines and for requiring that local governments meet these objectives.

With regard to State O&M programs, the report notes that some States have effective programs for upgrading and maintaining high levels of waste treatment effectiveness whereas other States have relatively ineffective programs. Some of the common elements of the more successful State programs include (1) adequate current plant design standards, (2) thorough review of treatment plant designs, (3) operator training, (4) operator certification, (5) detailed plant inspections, (6) detailed reporting of operating results, (7) reporting of plant failures, (8) technical assistance to improve laboratory and operational control, (9) adequate staffing and funding, (10) State grants for O&M, and (11) planning of regional treatment facilities.

The report states that--since many existing plants provide, and most future treatment plants will provide secondary treatment, or higher in some cases, and since the demands on available water resources will continue to increase--the need for effective O&M becomes increasingly critical. It adds that a nationwide O&M program should place emphasis on those efforts which have promise of realizing the most water pollution control for the money at the earliest date.

The report contained the following recommendations of measures to be taken as part of a comprehensive program to improve plant O&M.

1. Upgrade eligibility requirements for Federal grants by reviewing grant eligibility regulations periodically and making revisions as required to improve O&M.

With respect to the requirement for ensuring proper plant O&M, the Secretary of the Interior, in a letter dated July 15, 1969, to the Speaker of the House of Representatives, stated that:

> "We believe the State and the applicant should be able to demonstrate at the time of the approval of the grant *** that a sufficient number of operators will be provided and that operator personnel will be adequately trained; that equipment will be adequately maintained; and that laboratory and surveillance facilities are adequate to assure that the treatment plant will perform according to design specifications. We will insist on such assurance."

2. Upgrade waste treatment plant design criteria by:
    a. Carrying out a technical bulletin service to advise FWQA regions, States, and design engineers on new policy and technology as it affects sewage interceptors and waste treatment plants and design criteria.
    b. Preparing an FWQA manual of treatment works design guidelines through an FWQA-sponsored effort involving State and/or local agencies, design engineers, construction contractors, and others who can contribute to this effort.
3. Increase research and development to improve or develop new sewer and waste treatment plant design criteria, unit processes, and equipment and controls for automating plant operation.
4. Broaden the consulting engineer's responsibility by ensuring that his in-depth investigation and report adequately cover the broad areas of sewer infiltration and industrial wastes as they may affect the

capacity of municipal treatment works and the processing of wastes. Develop guidelines for use of FWQA regional staffs in evaluating whether applicants have met requirements such as having ordinances to protect plants against the harmful effects of industrial wastes.

5. Expand training and operator certification efforts by:

   a. Developing new and/or specialized training programs in waste treatment operations for the professional sanitary engineer responsible for the management and operation of waste treatment plants.

   b. Being alert to opportunities for encouraging and developing State operator certification legislation.

   c. Exploring the advisability of requiring a State mandatory operator certification program to qualify for Federal construction grant assistance.

6. Establish a special mission-oriented public information effort directed specifically toward elevating the stature of sewage treatment plant operators and supporting personnel within the community by dramatizing the need to attract competent personnel and by raising salaries.

7. Increase the effectiveness of waste treatment plant inspections by:

   a. Providing increased support and encouragement to State water pollution control agencies to strengthen their waste treatment plant inspections and evaluation programs.

   b. Developing a waste treatment plant inspection and performance manual to establish uniform methodology for evaluating plant operations, as well as establishing proper staffing and testing requirements.

c. Assigning at least one man in each region to the full-time task of developing and implementing a joint State and Federal program for inspection of federally assisted projects, including both new plants and those older plants suspected of having poor operations.

d. Establishing a reporting system whereby the State alerts FWQA to significant O&M problems.

8. Increase technical assistance by establishing a technical assistance program capable of providing expert advice on ways to improve treatment plant performance and solving difficult operational problems.

9. Establish incentives to upgrade the O&M of waste treatment plants, such as:

   a. Assisting the States in the planning and development of an awards program that recognizes excellence in treatment works design, operation, and maintenance.

   b. Establishing an FWQA-sponsored award program in those States where such a program does not exist.

   c. Establishing a supplementary FWQA regional awards program for recognition of outstanding performance and achievement in water pollution control.

Plant-operating manual

On March 17, 1969, the Department of the Interior Solicitor's Office, in response to a request from FWQA, issued an opinion that a grant for the construction of a waste treatment project could be awarded subject to the condition that the grantee require its consulting engineer to supply an operating manual and on-the-job training for plant employees. Subsequently, on March 28, 1969, the Acting Chief, Construction Grants and Engineering Branch, FWQA, sent a memorandum concerning the above opinion to all regional directors. The memorandum stated in part:

> "Therefore, eligibility for Federal grants for the construction of sewage treatment works under Section 8 of the Federal Water Pollution Control Act, hereafter shall be predicated on the requirement that the consulting engineer provide a plant operating manual. The manual shall be designed to describe the purpose, functions, and controls for each process in the specific plant, plus all physical and laboratory controls, maintenance functions, and personnel requirements necessary to operate the entire facility at maximum effectiveness. Normally, the basic manual will be available when plant operations commence. In addition, provisions will be made to have the manual amended by the consulting engineer as necessary during the first year of operations to include all changes or refinements, and thus describing substantially current plant operations.
>
> "The community, sanitary district, or other responsible public entity, must endorse and agree to fulfilling the tasks described in the manual. This will be considered minimum assurance that the treatment facility will be appropriately operated to achieve the applicable water quality objectives in the receiving waters."

Training

Traditionally, FWQA has viewed the training of waste treatment plant operators as being primarily a State responsibility. FWQA awards grants to States and to interstate agencies to assist them in meeting the cost of establishing and maintaining adequate measures for the prevention and control of water pollution, including the training of personnel of public agencies. Also FWQA supports the operator training programs of the States through technical consultations in the planning and development of operator courses, guest appearances of FWQA instructors, and provision of instructional material and training aids.

FWQA's first effort at direct training of waste treatment plant operators was a course entitled "Basic Principles of Wastewater Treatment Operation." The course was conducted from November 4 to 8, 1968, at the FWQA facility at Corvallis, Oregon, and 23 trainees attended the course. Two additional courses, involving 60 trainees, have since been given.

A course entitled "Operator Instructor Development," offered by FWQA for the first time during fiscal year 1969, is designed for those persons having responsibility for designing, managing, and teaching various types of short courses for waste treatment plant operators. The course reviews current teaching methods and the preparation and management of short-term, operator training courses. Two classes, involving 22 trainees, have been held.

FWQA is cooperating with other Federal agencies, especially the Department of Health, Education, and Welfare (HEW) and the Department of Labor, in utilizing existing Federal programs for the training for plant operators. One such program is the Cooperative Area Manpower Planning System program which involves State programs for training people for a large variety of occupations. The training is financed from various sources including funds available under the Manpower Development and Training Act.

FWQA is involved in this program at the national and regional levels. FWQA's role is to encourage and help the States formulate operator training projects and to arrange for funding of the projects. FWQA also provides assistance on curricula and teaching materials. These projects provide for both skill upgrading and the training of new people as waste treatment plant operators. During fiscal year 1969, 15 States, Puerto Rico, and the District of Columbia were involved in this program through either institutional training or on-the-job training coupled with classroom instruction. Approximately 980 trainees participated in the program at a cost of $1,161,555.

On April 1, 1969, FWQA entered into a contract with the Department of Labor and HEW under which Manpower Development and Training Act funds of $1,031,775 were provided to finance programs for the improvement of the skills of existing operators and for training new operators. The objectives of this program were the same as the objectives of the Cooperative Area Manpower Planning System program; however, FWQA serves as the prime contractor and subcontracts with municipalities or waste treatment districts for the actual training. As of March 1970, FWQA had entered into 28 subcontracts for training about 920 waste treatment plant operators.

On February 13, 1970, FWQA headquarters forwarded to its regional offices a manpower planning program which is being implemented by its Division of Manpower and Training to provide information on the requirements for and the supply of water pollution control manpower. In addition, FWQA is sponsoring and considering proposals for manpower studies to be conducted by private organizations and educational institutions.

ACTIONS BY THE STATES

The more important actions being taken by the States to improve plant O&M relate to procedures for providing operator training and certification programs, waste discharge permit systems, analyses of plant-operating reports, and plant inspections. The States included in our review have initiated or are considering various actions for further improving these procedures as discussed below.

Training

As shown in the table on page 9, each of the six States included in our review conducts an annual or semiannual training course for plant operators. The courses usually last from 3 to 5 days and generally consist of a series of lectures which cover both water and waste treatment plant operations. In addition, four of the States either conduct or participate in limited training programs for groups of operators in selected areas of the States.

Indiana, Kentucky, Oregon, Georgia, and Tennessee have made the following plans to provide additional training for plant operators.

Indiana plans to provide additional 3 to 4 day training courses sponsored by universities and to establish six to eight courses consisting of 1 night of training a week for 12 to 15 weeks, if a pilot course is successful. On March 26, 1970, the State water pollution control agency informed us that the State had sponsored a 44-week school for 88 plant operators to be financed with Manpower Development and Training Act funds.

Kentucky has conducted individual training sessions for laboratory procedures on an as needed basis. Also, Kentucky plans to upgrade 40 plant operators through 44 weeks of training to be financed with Manpower Development and Training Act funds.

Oregon is applying for a Federal grant of $60,000 under the Manpower Development and Training Act to set up either (1) night classes in waste treatment plant operation at each of the State's 10 community colleges or (2) a mobile laboratory for on-the-job training of operators. The mobile laboratory could also be utilized in reviewing the plant operations and solving plant problems.

Georgia has entered into a contract with the Department of Labor for the financing of on-the-job training for plant operators. Tennessee has also entered into such a contract and is considering adding a chemist to its staff to travel throughout the State and provide individual instruction in laboratory procedures to operators.

Available information shows, however, that some plant operators are not participating in these State programs. Officials knowledgeable in the field of waste treatment have advised us that a need exists to provide training for operators at more locations in the States. They have stated that some operators are unable to attend training courses because they live far from the training location, funds are not made available by the municipalities to defray their expenses while attending the training, or their attendance at the courses will leave the plants without operators.

Operator certification

Each of the six States also has an operator certification program to help ensure that waste treatment plant operators have the necessary qualifications. With the exception of Montana, the States generally require applicants to meet certain education and experience requirements and to pass a written examination to become certified. Montana's only requirement for certification is that an applicant pass a written examination. In general, individuals are certified to operate a plant under one of several classifications principally on the basis of the size of the population served by the plant. Operator certification requirements become more stringent as the size of the plant increases.

Certification of plant operators is mandatory in three of the selected States and voluntary in the others. State laws of the three States having mandatory certification programs permitted certain operators to become certified under a grandfather clause without an examination. The clause applied to those individuals who had been employed as waste treatment plant operators as of a certain date. For example, we found that this clause was the basis for certification of 188 of the 307 certified plant operators in Indiana and of 380 of the 391 certified plant operators in Montana.

Georgia, Oregon, and Tennessee currently have only voluntary operator certification programs. In March 1969, however, Georgia enacted a mandatory certification law for plant operators which will become effective July 1, 1972. Tennessee has introduced legislation to make the certification of operators mandatory. Similar legislation introduced by Oregon was not enacted, but Oregon now requires waste discharge permits to contain a clause which requires that plants be operated by qualified personnel.

Inspections

Georgia, Montana, Oregon, and Tennessee have made plans to increase the number of plant O&M inspections. Oregon has delegated part of its inspection responsibility to its district office personnel. Georgia and Tennessee plan to increase such inspections as soon as they are able to hire additional staff members. Montana has recently hired two additional staff members who will be used in making plant inspections.

Other actions

Oregon plans to use automatic data processing equipment to accumulate and process information from waste discharge permits, monthly plant-operating reports, and inspection reports to assist in identifying plants that have problems and in following up on correction of the problems.

Tennessee is considering the establishment of a regional office in the western area of the State similar to one located in the eastern area to monitor waste treatment plant operations.

CHAPTER 5

FEDERAL AND STATE COMMENTS AND OUR EVALUATIONS

On March 2, 1970, drafts of this report were submitted to the President's Council on Environmental Quality, the Department of the Interior, and the State water pollution control agencies of the six States included in our review. The recipients agreed, in general, with the findings discussed in the report. The comments of the Council on Environmental Quality, the Department of the Interior, the States, and our evaluation thereof are discussed below.

COUNCIL ON ENVIRONMENTAL QUALITY EXECUTIVE OFFICE OF THE PRESIDENT

By letter dated March 13, 1970 (see app. V), the Council on Environmental Quality, Executive Office of the President, stated that:

> "Your report represents a most thorough effort on an important subject. No matter what level of funds are made available for the construction of new treatment facilities, we cannot achieve our water pollution control goals unless these and existing plants are properly operated and maintained."

The Council expressed the belief that:

> "*** the President's recommendations, coupled with some of the additional recommendations made by the General Accounting Office will help achieve a better investment of Federal, State and local funds and higher levels of water quality."

DEPARTMENT OF THE INTERIOR

By letter dated April 9, 1970 (see app.VI), the Department of the Interior stated that it was in substantial agreement with our findings. The Department stated also that our report had made reference to departmental actions under way to improve the O&M of waste treatment plants and that it was confident that the inspections which were called for in a proposed amendment to the Code of Federal Regulations (see p. 15) would further strengthen the Commissioner's authority to initiate solutions to the O&M problems cited in our report.

Although the full import of this amendment is not clear at this time, we believe that, in general, the proposed amendment to the Code of Federal Regulations and the agency actions under way that are directed toward improving the O&M of waste treatment plants are in line with our recommendations contained in chapter 2. Timely implementation of certain provisions discussed in FWQA's operation and maintenance program (see ch. 4) would contribute to improved O&M. Such provisions include (1) establishing staffing and testing requirements for use in evaluating plant operations, (2) developing guidelines for use of FWQA regional staffs in evaluating whether applicants have met other requirements, such as having ordinances to protect plants against the harmful effects of industrial wastes, and (3) preparing an FWQA manual of waste treatment plant design guidelines.

STATE WATER POLLUTION CONTROL AGENCIES

Although formal comments had not been received from Georgia and Tennessee, officials of the States' water pollution control agencies orally expressed general agreement with the findings in the report. Comments from Indiana, Kentucky, Montana, and Oregon are presented in appendixes VII through X.

Both the Kentucky and Oregon State water pollution control agencies commented on the plants we visited in each of the two States. Kentucky stated that, of the 15 plants we selected for review in the State, the two that were experiencing difficulty in producing a satisfactory effluent were thoroughly discussed in the report while no mention was made of the 13 plants that were producing satisfactory effluent. Oregon stated that the two examples discussed were in no way typical of the programs to be found in most of the other 250 plants in the State.

The problems experienced at the 12 plants discussed in appendix III of this report were not necessarily typical or generally representative of conditions at all waste treatment plants throughout the six States. As stated on page 18, we visited, for the purpose of making a detailed review, plants where it appeared that serious O&M problems existed. However, O&M problems were not limited to the 12 plants. FWQA inspection reports available for 54 of the 69 plants included in our review showed that 40 plants had experienced operational, mechanical, or structural problems. A review of 26 plants in two States showed that six of the plants had experienced problems with industrial wastes. Further, an FWQA report on inspections of 1,500 waste treatment plants showed that many plants inspected had experienced operational, mechanical, and structural problems. (See p. 16.)

The Montana State water pollution control agency stated that it recognized a need to improve operation and maintenance at some plants and that our "*** report is an attempt to provide better operation and maintenance ***." The agency expressed concern, however, that general statements about poorly operated waste treatment plants could have an adverse effect on the operators who were doing a good job. Although we recognize that many waste treatment plants may be operated by a sufficient number of qualified operators, there is general agreement that the lack of qualified operators is one of the major obstacles that must be overcome in order to provide for the proper and efficient O&M of waste treatment plants.

The Oregon Department of Environmental Quality stated that the Department would continue its efforts to provide the best possible treatment of all wastes before they were discharged into the receiving waterways and would continue upgrading the operating skills and promoting adequate operating budgets at the local level. The Department added, however, that the biological treatment processes used in waste treatment did not lend themselves to absolute quality control and that the quality of effluent from these plants might vary from time to time, without constituting a complete breakdown in operation and maintenance.

We recognize that it may be difficult to retain absolute quality control at waste treatment plants. However, noticeable and sustained variations from an established standard, such as the designed BOD removal rate, may be indicative of operational problems. Procedures such as laboratory control and plant-operating reports are utilized to detect such variations and alert State agencies to plants which may be experiencing O&M problems.

The Indiana State water pollution control agency generally concurred with our recommendations and stated that the States were in the best position to control the O&M of waste treatment plants and that efforts were being made to obtain adequate O&M of all plants. The agency stated that, although the data on Indiana plants was considered essentially factual at the time of the investigations, improvements to these facilities have since been made and that these improvements could be attributed to the requirements and insistence of the State agency.

The Kentucky water pollution control agency stated that it had long been aware of the need for improved operation and maintenance of waste treatment plants. The agency stated that the report did not bring out in significant detail the fact that the primary function of waste treatment plants was to produce an effluent that would protect the receiving stream. The agency stated also that Kentucky law dictated that each plant would have at least one certified operator and that the effluent would meet the design requirements of the plant.

We recognize that the primary function of a waste treatment plant is to produce an effluent which meets State requirements and that State laws may require a plant to meet these requirements. However, we believe that, in the absence of independent tests by State water pollution control personnel, the actual quality of a plant's effluent often may be unknown. In this regard we noted that (1) many plant-operating reports were not submitted to the States, (2) operating reports which were submitted did not always contain sufficient data to permit the measurement of the degree of treatment being achieved, and (3) operating reports submitted were not always regularly reviewed by the

States. In addition, many of the plants included in our review were not performing the laboratory tests or maintaining the records necessary to monitor plant operations.

APPENDIXES

COMPARISON OF ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS BETWEEN VARIOUS TYPES AND SIZES OF WASTE TREATMENT PLANTS

Size (flow--million gallons a day)	Type (note a) and estimated annual O&M costs (note b)		Ratio of annual O&M costs
	Primary treatment	Activated sludge	
0.1	$ 5,930	$ 6,360	1 to 1.1
1.0	22,900	34,100	1 to 1.5
10.0	88,400	183,000	1 to 2.1
100.0	357,000	983,000	1 to 2.8
	High-rate trickling filter	Activated sludge	
0.1	$ 5,360	$ 6,360	1 to 1.2
1.0	21,400	34,100	1 to 1.6
10.0	93,700	183,000	1 to 2.0
	Primary treatment	High-rate trickling filter	
0.1	$ 5,930	$ 5,360	1 to 0.90
1.0	22,900	21,400	1 to 0.94
10.0	88,400	93,700	1 to 1.06

[a] Activated sludge and high-rate trickling filter plants are secondary treatment processes. The high-rate trickling filter is generally not used to process large flows of waste water.

[b] Costs expressed in 1968 dollars. These estimates represent the results of an FWQA study of data submitted by 1,600 plants between 1965 and 1968. The study did not exclude poorly operated plants, make allowances for regional cost differences, or ascertain the reliability of the data furnished.

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COMPARISON OF
ESTIMATED CONSTRUCTION COSTS WITH
ESTIMATED TOTAL OPERATION AND MAINTENANCE COSTS
OVER THE LIFE OF THE PLANTS
BY VARIOUS TYPES AND SIZES
OF WASTE TREATMENT PLANTS (note a)

Type (note b)	Size (flow--million gallons a day)	Estimated construction costs (note c)	Estimated total O&M costs over life of plant (note d)	Ratio of construction cost to O&M costs
Waste stabilization ponds	0.1	$ 45,000	$ 25,750	1 to 0.6
	1.0	112,000	92,250	1 to 0.8
Primary treatment	0.1	72,000	148,250	1 to 2.1
	1.0	341,000	572,500	1 to 1.7
	10.0	1,610,000	2,210,000	1 to 1.4
	100.0	7,560,000	8,925,000	1 to 1.2
High-rate trickling filter	0.1	79,400	134,000	1 to 1.7
	1.0	380,000	535,000	1 to 1.4
	10.0	1,820,000	2,342,500	1 to 1.3
Activated sludge	0.1	81,400	159,000	1 to 2.0
	1.0	428,000	852,500	1 to 2.0
	10.0	2,260,000	4,575,000	1 to 2.0
	100.0	11,900,000	24,575,000	1 to 2.1

[a] Costs expressed in 1968 dollars.

[b] Waste stabilization ponds, high-rate trickling filter, and activated sludge are secondary treatment processes. The waste stabilization ponds and the high-rate trickling filter are generally not used to process large flows of waste water.

[c] Based on daily design flow. These estimates do not include the cost of land. The data is from an FWQA study of about 2,500 FWQA-assisted projects completed or under construction as of December 1966.

[d] Based on average daily flow. These estimated O&M costs were based on an FWQA study of data reported by 1,600 plants between 1965 and 1968 and on an average estimated useful plant life of 25 years but did not allow for inflationary influences on O&M costs over the 25-year period. The FWQA study did not exclude poorly operated plants, make allowances for regional cost differences, or ascertain the reliability of the data.

OPERATION AND MAINTENANCE PROBLEMS

IDENTIFIED AT SELECTED PLANTS

Of the 69 waste treatment plants included in our review, we selected in each of the six States two plants which appeared to have serious O&M problems. Our principal findings at each of the 12 plants are discussed below. The total amount of Federal construction grants for each plant is also shown.

PLANT 1--$75,929

This secondary treatment plant, with an estimated flow of about 0.5 million gallons a day, was inspected by FWQA around September 1968. The 1963 Conference of State Sanitary Engineers recommended that, for a plant of this size, provisions be made for, as a minimum, one full-time operator and a half-time laborer, six tests for laboratory control, a diary-type log of operating information, and a record of laboratory control results.

The FWQA inspection report for this plant showed that the plant did not have the recommended full-time operator but did employ a full-time laborer and a plant supervisor who devoted 6 hours a week to the plant, that laboratory tests were not being performed, and that operating records were not being maintained.

The plant facilities consist of a primary treatment plant and a 20-acre stabilization pond for secondary treatment. A memorandum in the FWQA files, dated October 4, 1968, noted that the plant was severely overloaded, which resulted in poor removal of solids, and that the problem appeared to be caused by a meat-packing plant slaughterhouse which released blood and large, unusable portions of slaughter into the sewage system.

During our February 1969 visit, we observed a large quantity of blood in the influent, grease scum floating on the primary clarifier, and some grease on the surface of the stabilization pond. We also noted that dried sludge was deposited along the outside of the sludge-drying beds.

We revisited the plant in August 1969 and found that the above conditions still existed. In addition, the plant had experienced flooding problems during periods of heavy rainfall because the top of one of the process facilities was constructed at ground level and the digester gas burner was not working because of a need for new parts.

We also noted that laboratory testing equipment had not been provided at the plant. A municipal official advised us that the city had no plans to purchase laboratory equipment since no one was available to use it if it were acquired.

Municipal officials stated that

--information was not available to show the planning that had been done for plant O&M,

--the plant began to operate about 1963 but no full-time employees were assigned to the plant until about 1967 when the full-time laborer currently employed was hired because of the previous city manager's lack of interest in the plant,

--the municipality did not plan to hire an operator unless required to by the State because it could not afford to do so,

--the major problem which caused the ineffective operation of the plant was industrial wastes,

--the industry which produced the wastes was attempting to pretreat the wastes but that it was not successful,

--to improve plant O&M, more guidance and financial assistance by the State or FWQA were needed, and

--neither the State nor FWQA had provided any advice on plant O&M requirements or information regarding the conference recommendation for plant O&M.

PLANT 2--$60,870

This secondary treatment plant, with an estimated flow of about 1 million gallons a day, was inspected by FWQA on September 9, 1968.

The FWQA inspection report stated that any estimate of plant efficiency would be a very poor guess because of the lack of records. The inspection report also noted that the trickling filter unit was ponding[1] over 25 percent of its surface and that the secondary clarifier appeared to be passing a large quantity of solids.

A State inspection memorandum, dated February 12, 1969, showed that the plant did not have chlorination facilities and recommended that the plant-operating permit be withheld until such facilities were added.

We visited the plant in February 1969. It had no operator but the city's superintendent of water and sewage operations stated that he devoted about 15 hours a week to the plant and that the equivalent of 2-1/2 plant laborers were employed. He stated also that the city was trying to hire an operator at a salary of $350 a month. We found that laboratory tests were not being made and that neither laboratory control records nor any other operating records were being maintained. We also observed that surface drainage was poor, which resulted in erosion, and that the trickling filter unit was ponding over about 10 percent of its surface.

We visited this plant again in July 1969 and found that, in general, the above problems still existed and that additional problems were being experienced. The problems included (1) sewage bypassing treatment due to an improperly seated gate valve, (2) an inoperative primary clarifier due to a broken chain drive and a broken flight bar in the skimming mechanism, (3) an uneven flow into a primary clarifier which, according to a municipal official, was due to a design deficiency, (4) inadequate skimming of grease and scum in one of the primary clarifiers caused by improper positioning of rear weir bars apparently due to a design deficiency, and (5) inflow of blood and pieces of meat from a slaughterhouse due to inadequate pretreatment by the industry.

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[1] Ponding is the formation of pools of sewage on the surface of filters caused by surface clogging.

Municipal officials stated that most of the deficiencies had been caused by the lack of a qualified operator and that a lack of funds had precluded their hiring a qualified operator. They advised us that a qualified operator could have identified and either have corrected, if sufficient funds were available for repairs, or have recommended means of correcting the deficiencies, including those apparently due to improper design. Concerning the industrial wastes, they stated that the slaughterhouse would construct facilities to treat its wastes and that, after the facilities are placed in operation, the industrial waste problems should be eliminated.

The officials told us that they had received only limited technical assistance regarding plant O&M from the State or from FWQA and that they believed operating guidelines as well as financial aid would assist them in correcting the O&M problems.

The municipality supplied us with only limited information regarding its planning for O&M needs. Municipal officials advised us that they had planned to fund O&M for the new plant at the same level as that provided for the old plant. They stated, however, that additional funds were needed, primarily to recruit and retain certified operators to make the tests and to properly supervise plant operations.

PLANT 3--$230,702

This secondary treatment plant, with an average flow of about 1.8 million gallons a day, was placed in operation in September 1966 and was inspected by the State, for FWQA, in December 1967.

The State inspection report submitted to FWQA showed that all the 1963 conference recommendations had been met, except the making of dissolved-oxygen tests in the receiving waters. The inspection report noted, however, that the extent of BOD and solids removal was not considered adequate and that the plant would be required to install advanced equipment to provide for low-flow augmentation within 10 years.

During our January 1969 visit to the plant, we noted that plant laboratory records were not current. The plant superintendent told us that he had been busy training a new operator and did not have time to perform all the laboratory tests. The plant operator told us that the plant had not operated effectively since its construction because of the high concentration of industrial waste and the State inspector advised us that infiltration from rainwater contributed to the problem by overloading the plant and causing sewage to bypass the treatment plant.

Correspondence in the State files indicates that industrial wastes, high in chrome content, may eventually cause damage to the plant if they are not pretreated. Also, plant-operating reports in the State files showed that the plant was not meeting the State standards for BOD removal.

We revisited the plant in September 1969 and found that a qualified operator had not been provided to fill a recent vacancy. Overloading and industrial waste problems were still being experienced.

Municipal officials told us that they had not been able to find a qualified operator and, as a result, no laboratory testing was being done. The city mayor advised us that a consultant had been hired to help solve the plant's problems. He pointed out that, although the plant had been designed for 25 years into the future, it was having an overflow problem after only 3 years of operation. He expressed the belief that the plant design might not have been adequate because consideration had not been given to the population growth which resulted from the construction of an interstate highway through the city.

At the time of our visit, one of the companies which had been contributing to the plant's industrial waste problems was constructing pretreatment facilities. The city engineer told us, however, that the plant was having problems with industrial waste from a slaughterhouse. The city attorney stated that he did not believe the city could require industries to pretreat their wastes.

According to the city engineer, neither FWQA nor the State had provided information to the city regarding the 1963 conference recommendations or other information concerning the importance of providing for proper plant O&M.

PLANT 4--$74,199

This secondary treatment plant has an average daily flow of 16.9 million gallons a day. The plant was placed in operation in 1967 and was inspected by the State for FWQA on December 18, 1968.

The inspection report showed that all the 1963 conference recommendations had been met with the exception that four of the nine required tests were not made at the recommended frequency.

The plant-operating reports submitted to the State showed that the plant had not met the State standards of waste removal during any month of the 5-month test period that we selected for review. A State letter to the plant, dated December 26, 1968, commented that there was a need for improvement in BOD and suspended solids removal.

A preliminary engineering report estimated that 40 percent of the plant's influent would be from industrial sources. During our visit to the plant on March 25, 1969, the assistant plant superintendent told us that the plant had been experiencing problems from large amounts of chrome and other plating wastes. The plant superintendent advised us that, although the municipality had an industrial waste ordinance, it had never been enforced "because the city depends on industry for survival."

We revisited the plant on September 11, 1969, and found that the plant was still experiencing problems with industrial waste. We observed that both the influent and effluent were a dark-green color. The assistant plant superintendent explained that the influent was green because a local industry was still releasing its chrome waste into the plant.

Plant officials advised us that sometimes a meat-packing plant fails to pretreat its wastes and that this causes operational problems. We noted that the weirs in two of the four settling tanks were clogged by solids and that the receiving stream was covered with foam.

Plant officials told us that the State had stressed the importance of proper O&M at the time the application for a Federal construction grant was submitted and that the consulting engineer and the contractor had assisted in debugging the completed plant.

PLANT 5--$121,920

This secondary treatment plant, constructed in 1939 and expanded with the aid of Federal funds in 1965, has an average daily flow of 1 million gallons a day. An FWQA official told us that FWQA did not make the inspection of this plant as required by FWQA's "Handbook of Procedures--Construction Grants Program." For this size plant, the 1963 conference recommended a minimum of 6 hours a week of administrative supervision, two operators, and one laborer.

During our visit to the plant in February 1969, the plant superintendent told us that the plant had one supervisor and two operators but no laborer. He stated also that records of laboratory tests were not maintained.

A State inspection report dated November 26, 1968, stated:

> "During the past eighteen months the quality of the effluent discharged from the *** Plant has progressively worsened to the point that *** the receiving stream has presented an unsightly

> appearance for the past five months. Recently this office has received complaints of this unsightly appearance *** which means that this condition prevails through the entire 15.1 mile stretch of [the receiving] Creek from the sewage treatment plant to the *** River and, after being greatly diluted, is still noticeable in this 4.6 mile stretch of the *** River. ***
>
> "During the past year, the city has made progress in rehabilitating the plant units and grounds. Through the years a lack of operational knowledge, together with negligent maintenance practices, the plant had deteriorated virtually to the point of destruction. *** In spite of the efforts thus far exerted, the efficiency of the sewage treatment plant, based on the writer's observations and excepting the few brief periods when industrial wastes were being withheld from the plant, appears to be rapidly diminishing and will very soon, if not now, reach the point at which it will be of no practical value towards fulfilling its intended purpose."

A State official advised us that the portion of the State inspection report dealing with the deterioration of the plant concerned mainly that portion constructed in 1939 as a Work Progress Administration project and not the expanded facilities constructed in 1965.

During our visit to the plant, we observed that, for about 100 yards downstream from the outflow pipe, the receiving stream was covered with 4 to 6 inches of foam and that the effluent was red in color and changed to black downstream. The plant superintendent told us that the unsightly appearance was the result of tannery wastes being discharged to the treatment plant.

We revisited the plant in August 1969 and observed dark-red influent ponding on the trickling filter, foam and scum on the water in the chlorine chamber, discolored effluent with a red appearance, and foam in the receiving stream. Plant officials had previously advised us that the poor quality of the effluent and the resulting effect on the receiving stream were due to the tannery wastes, car wash detergents, and packinghouse wastes.

Plant officials also stated that the tannery had failed to properly maintain its lagoons and provide for the necessary pretreatment of its industrial waste. They further advised us that they did not enforce a sewer ordinance which would have prevented the industrial waste problems from occurring at the plant because the city was afraid that it would force the industry out of business and thus cause the city to lose employment benefits provided by the industry.

Plant officials told us that the city had made plans to replace the plant and that the new waste treatment plant would be designed to handle both domestic and industrial wastes. They said that the necessary funds for the new plant were to be provided by grants from FWQA and the Economic Development Administration and a loan from the Department of Housing and Urban Development.

City officials stated that they had not planned for the required O&M of the present plant because they had thought that once constructed, waste treatment plants were more or less self-operating. They stated also that no guidance or assistance regarding the importance of providing for proper plant O&M had been provided at the time the city applied for a construction grant by either the State or FWQA. They also advised us that they had not been furnished a copy of the 1963 conference recommendations.

PLANT 6--$118,429

This plant, a 0.35-million gallon a day trickling-filter facility (secondary treatment), was completed on March 11, 1966, and was visited by FWQA in 1968.

The memorandum of the FWQA visit to this plant noted that the effluent appeared to be untreated and that the plant was in extremely poor operating condition, generally to the point of being rendered ineffective. The memorandum also stated that "the operator, who was aware that we were to be in town, made himself unavailable" at the time of FWQA's visit.

A State inspection report, dated November 4, 1968, stated that the operator was not present, the flowmeter was not working, all processing units were black in color and odorous, gas was forming in the chlorine contact chamber, and the effluent was cloudy and odorous.

An operator was not present during our visit to the plant in February 1969. A State official told us that, although the plant was experiencing some difficulty from infiltration, the major problem was staffing. We observed that all the untreated sewage was bypassing treatment but was being channeled through the chlorine chamber and into the receiving stream.

A State official told us that this plant was staffed with one operator who contributed about 5 hours a week to plant operations and that no time was spent performing tests or maintaining records. The 1963 conference recommendations for a plant having a capacity of 0.25 million gallons a day provide for an operator to contribute 5 hours a week to laboratory testing and records.

When we revisited the plant on August 27, 1969, the operator and two laborers were present and the plant was operating. The operator told us that the infiltration problem still existed. He told us also that neither the conference recommendations nor any other information had been furnished to the city by either the State or FWQA regarding the requirements for proper operation and maintenance of the plant and that apparently the city was not aware of what would be required to operate and maintain a sewage treatment plant.

A city official told us that funds were not available to provide for increased staffing of the plant. He said that the city felt that it could not increase its water and sewage rates which were already very high.

In April 1970 a State official informed us that the bypassing of untreated sewage into the receiving stream had been stopped.

PLANT 7--$72,133

Additions and modifications to this secondary treatment plant, now designed for a capacity of 0.1 million gallons a day, were completed in March 1967 and the plant was inspected by FWQA in September 1968.

According to the 1963 conference recommendations, the minimum requirement for a plant having a capacity of 0.25 million gallons a day is at least a half-time operator. The plant supervisor told us that personnel spent about 9 hours each week operating the plant.

State records showed that the plant had not met design standards of operating effectiveness for 4 months of a 5-month test period and that records of laboratory test results had not been provided to the State for 1 month of the test period. The plant supervisor informed us that he did not have enough trained personnel available to keep the plant operating efficiently.

The FWQA inspection report dated September 1968 stated that the type of rock used as filter media in the trickling filter of the plant caused flooding over about 40 percent of the filter area. The report noted that the plant was not providing the degree of treatment required by the State and that the waste discharge permit required that the plant either be abandoned or upgraded. A State official informed us that the State recommended abandonment because the plant was overloaded and the receiving stream was too small.

During our January 1969 visit, the plant supervisor informed us that the above condition still existed and that the poor filter media were a factor which contributed to the plant's inability to meet State requirements. At the time of our visit, the secondary treatment portion of the plant was not operating because a distributor arm on the trickling filter had recently broken.

We revisited this plant in June 1969 and found that the distributor arm on the trickling filter had been repaired and that the rock used as filter media had been replaced. The plant supervisor informed us that the plant was then operating near the State standards and that the plant would meet the State standards if a full-time operator could be provided. A county official advised us, however, that the county could not afford to provide a full-time operator at the plant.

The plant supervisor told us that the then current plan was to phase out this plant by about June 1970. In a effort to consolidate plants, the county had planned to construct an interceptor which would transport sewage from this plant to another plant presently under construction in a nearby municipality.

The plant supervisor advised us that planned funding for O&M of the plant, at the time of applying for the construction grant, was based on the level of costs incurred to operate the plant prior to the modifications even though the new plant was to be more complex than the old. He added that the county had planned to continue working the present employee the same number of hours as before and to utilize a laboratory at another plant for testing.

A county official advised us that no information had been furnished to the county by the State or FWQA regarding the provisions necessary for proper O&M. He also stated that a copy of the 1963 conference recommendations had not been furnished to the county.

PLANT 8--$61,901

This tertiary treatment plant was placed in operation in 1966. An FWQA inspection on June 14, 1968, showed that the plant had an average daily flow of 1.4 million gallons a day.

The 1963 conference report did not cover minimum personnel requirements for tertiary plants. But, for a lower level secondary treatment plant, equivalent in capacity, the report recommended a minimum of 6 hours a week of administrative supervision, two operators, and one laborer.

The FWQA inspection report showed that the city had provided no administrative supervision, only one operator, and no laborer. In the area of laboratory controls, the report indicated that only four of seven tests recommended by the conference were being performed and that only two of the tests were being performed at the recommended frequency. The report noted that arrangements had been made to have testing done at another waste treatment plant in the vicinity and that the operator had kept weekly instead of daily laboratory records.

State records of the plant's operations showed that, for a 5-month critical flow period in 1968, the plant failed to operate to design standards for 2 months and that laboratory test information necessary to determine operational effectiveness was not reported for another 2 months.

The city engineer advised us that the city had allowed the operator of the existing primary treatment plant to operate the new plant during the first year of operation. He stated that the operator was not qualified to operate the new plant but that the city had granted his request to do so because of his past record of over 40 years' service to the city in various capacities. This operator retired in July 1968 and the city engineer operated the plant until September 1968 when a new operator was hired.

At the time of our visit to the plant in January 1969, the plant operator told us that, because he had no help, he often had to forego testing and preventive maintenance to make repairs.

The city engineer informed us that water infiltration in the old sewer system created an overload problem at the plant and that occasionally during the winter months, because of the combined storm and sanitary sewer system, it was necessary to bypass up to three forths of the load directly to the receiving stream without treatment. In addition, he stated that the high volume of infiltration diluted the sewage to a point where it was difficult to keep the bacteria on the filter media alive, which resulted in reduced plant efficiency.

We revisited the plant in June 1969 and found that it still had only one operator. The city engineer advised us that the plant operator had modified plant operations so that the plant operated as an activated sludge process instead of the designed trickling-filter process.

He said that the redwood lath filter was designed too small to operate well as a trickling filter and the process modification had resulted in a significant improvement in the BOD and solid removal levels.

In July 1969 the State inspected the plant and found that the treatment process was disrupted and that the plant was not functioning properly. This was attributed to the fact that the operator had gone on vacation the week before and an inexperienced person had been left in charge. The city engineer agreed with State personnel that an additional operator was needed but he stated that funds were not available to hire more than a half-time laborer. The plant operator advised us that he believed two operators should be provided to assist him but that money was not available in the city's budget. The city engineer also advised us that, in terms of funding priorities, the sewage treatment plant was low on the list.

The city engineer has stated that infiltration is still a problem but that the city has developed a comprehensive plan to replace the sewer system.

The city engineer stated also that, in planning for plant O&M at the time of applying for the construction grant, the city neither requested nor received any guidance from either the State or FWQA. We noted that the consulting engineer's report referred to the 1963 conference recommendations for O&M. The city engineer stated, however, that the city had not followed the recommendations in planning for O&M of the modified plant. He stated also that funding levels for plant O&M were based on funding data shown in the consulting engineer's report.

PLANT 9--$51,820

This secondary treatment plant was placed in operation in 1966. The average daily summer flow is about 0.39 million gallons a day.

For a plant of this size the 1963 conference recommended that three tests be made. However, the plant operator stated that he did not know how to make more than two tests. Because reports of laboratory test results were not prepared by the operator, we were unable to determine whether the plant was operating effectively. County officials told us that the conference recommendations were not followed in planning for O&M.

A July 1968 FWQA inspection report on the plant disclosed that a comminutor for grinding incoming sewage and sight glasses for monitoring sewage flow in sludge-pump lines had not been provided when the plant was built. The report stated that rags and stringy materials were causing ineffective operation of the sludge pumps and that the efficiency of the pumps could not be monitored because of the lack of sight glasses.

At the time of our initial visit to the plant in February 1969, the plant operator informed us that the comminutor and sight glasses had not yet been ordered. The plant operator informed us also that the plant effluent was discharged into a lagoon designed to overflow into moats which would allow the effluent to evaporate or percolate into the ground. He stated, however, that, during periods of heavy rainfall, the algae growth in the lagoon overflowed into the moats and sealed them, thereby causing the moats to overflow into the surrounding area. The plant operator stated also that this problem had occurred in August 1968 and that an additional moat had been constructed to help correct the condition.

When we revisited the plant on July 14, 1969, the plant operator told us that, except for the condition of the moats, none of the above problems had been corrected. While we were at the plant, the sludge recirculation pumps stopped twice and had to be cleaned by the operator. The operator said he had to clean these pumps two or three times daily.

We also observed that sewage solids were floating on top of the clarifier instead of settling to the bottom. The operator told us that nearly all his time was spent cleaning the sludge pumps and pushing the solids down into the clarifier.

A July 1969 State inspection report pointed out, in general, the same problems identified in FWQA's 1968 inspection report. A State official told us that he had discussed the plant's problems with municipal officials and that they were willing to purchase the necessary equipment to correct the problems if the cost would not exceed $1,800. However, the State official estimated that the total cost could easily exceed $5,000. He said that he had also discussed these problems with the municipality's consulting engineers and they told him that they would visit the plant to study the problems further.

On March 20, 1970, a State official advised us that a screen would be installed temporarily to filter out solid materials and that a comminutor would probably be installed in 1971.

County officials told us that they had neither asked for nor received any guidance from the State or FWQA in planning for the O&M of the plant. They stated that planning for plant O&M was left up to the county's consulting engineers and that the county relied upon the engineers' recommendations. We reviewed the O&M section of the engineers' report and found that it did not contain recommendations regarding the personnel and laboratory controls needed for plant O&M.

PLANT 10--$13,500

This plant, a lagoon, was placed in operation in September 1966 and was inspected by FWQA on July 1, 1968. It has a reported flow of .012 million gallons a day.

The smallest plant covered in the conference recommendations is a plant with a capacity of 0.25 million gallons a day. For that size plant, the conference recommended that three tests be performed and that 5 hours a week be spent on recordkeeping.

When we visited the plant in February 1969, the plant operator told us that he was not aware of any major O&M problems. He explained that he had not been to a sewage treatment school, was not performing laboratory tests, and was not maintaining detailed records of operations. Because of the lack of laboratory tests and operating records, we were unable to determine whether the plant was operating effectively.

Essentially the same conditions existed when we revisited the plant in July 1969. The city mayor told us that any O&M planning would have been done by the consulting engineers. We noted, however, that the engineering report on the plant contained no information regarding plant O&M. The mayor also informed us that the 1963 conference recommendations had not been followed in planning for O&M needs and that he was not aware of any O&M guidance provided by either the State or FWQA.

The plant operator informed us that, although he had never attended any sewage treatment schools, it was not because he was not interested. He stated that he would like to attend the State's annual operator training school but that the city would not pay his way. A city official explained that he felt that the plant operator was already able to properly operate the plant and did not need additional training to do the job.

PLANT 11--$250,000

This primary treatment plant, with an average daily flow of 1.5 million gallons a day, was placed in operation in 1960.

An October 1968 FWQA inspection report showed that the plant met the 1963 conference personnel recommendations but that three of the seven recommended tests were not being made and that another test was not being made at the required frequency. Our review of the plant-operating reports submitted to the State showed, however, that the untreated sewage bypassed the treatment plant several hours each month during 1967 and 1968. State correspondence revealed that complaints had been received concerning chicken feathers and entrails floating on a lake and that the source of the waste had been traced to the treatment plant.

During our visit to the plant in February 1969, the plant operator told us that feathers and other wastes from a poultry-processing facility had clogged the plant's clarifier. A State official advised us that the operator's solution to the problem had been to periodically flood the wet well to wash the waste directly to the receiving stream.

In July 1968 the State revoked the plant's 5-year permit and issued a 1-year permit with the recommendation that the city adopt and enforce a sewer ordinance to protect the plant and prevent stream pollution.

During our visit to the plant in August 1969, we found that untreated sewage was not bypassing the plant and that the city council had passed an ordinance to control the discharge of waste from the poultry-processing plant.

A municipal official advised us that there were no records available to show the planning for O&M of the plant or how much guidance had been provided by the State or FWQA. He also stated that they did not have a copy of the 1963 conference recommendations.

PLANT 12--$92,502

This secondary treatment plant, with an average daily flow of 0.70 million gallons a day, was placed in operation in 1965. A plant inspection was conducted by the State for FWQA in September 1968. The inspection report showed that the plant did not employ the half-time laborer recommended by the 1963 conference and did not make one of the recommended tests.

A State official told us that, shortly after the plant began operation, the need to heat the digester became apparent and that a heat exchanger and a recirculation pump were added to the plant. Municipal officials advised us that the pump had not functioned properly. According to these officials, the pump would not pass solid matter through the heat exchanger and back to the digester. Therefore, a constant temperature could not be maintained to allow the bacteria to perform its proper function. The operator told us that, since the digester was not working properly, no digester tests were performed and no data was available for preparing monthly operating reports.

Information in State correspondence files indicated that odor had been a serious problem at the plant. A State official told us that sewage bypassed the plant for about 2 months during the latter part of 1967 because coal had stopped up the clarifier.

During our visit to the plant in July 1969, a municipal official advised us that problems were experienced with the recirculation pump all during 1967 and that the problems still existed. He stated that (1) the pump clogged and had to be cleaned daily by hand, (2) the contractor changed the pump impellers apparently to correct the problem, and then (3) in December 1968 the pump motor burned out. He informed us, however, that a new motor had been ordered.

With regard to the digester heat exchanger, a State official told us that, prior to construction of the plant, the State had recommended that a heat exchanger be installed but the city had decided against it because the consulting engineer had said it was not necessary.

A municipal official advised us that odor was no longer a serious problem at the plant. He advised us also that there was no information available to show the planning for O&M of the plant or the guidance received from the State or FWQA and that the municipality had not been furnished a copy of the 1963 conference recommendations.

Recommendations for

MINIMUM PERSONNEL, LABORATORY CONTROL and RECORDS

For Municipal Waste Treatment Works

by
THE CONFERENCE OF STATE SANITARY ENGINEERS
in cooperation with
U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
1963

RECOMMENDATIONS
for
MINIMUM PERSONNEL, LABORATORY CONTROL, AND RECORDS
for
MUNICIPAL WASTE TREATMENT WORKS

INTRODUCTION

Experience has demonstrated the need for improved operation of domestic wastewater treatment plants. This need has been demonstrated throughout the full range of plant sizes although the tendency in general is more evident as the plant decreases in size.

Concurrent with the large number of new treatment plants placed in service since the inception of the Federal construction grants program in 1956 has been the increased awareness of these needs. In many locations this construction program has brought to communities for the first time the responsibility of operating and maintaining a wastewater plant. For others it has increased capacity or provided for a higher degree of treatment.

Increasing concentration of population in urban areas has caused changing needs for all services in most communities. Increasing demands on streams for water supply, recreation, and other uses have stepped up the requirements for wastewater treatment efficiency. In many instances these requirements have increased without full realization by the communities.

Therefore, to assist all communities with new or existing treatment facilities toward a better understanding and execution of their responsibilities, a minimum framework of control procedures was developed. These procedures provide a fundamental basis on which to begin. They also establish a basis on which to build toward further improvement. It is important to understand that these recommendations are minimum at this time because the demand for higher degrees of treatment will increase as the population increases and urbanization trends continue.

Three fundamental components required in the consideration of sound operating techniques for any waste treatment plant are: (1) personnel, (2) laboratory control, and (3) records.

A plant must be staffed with certain personnel who are trained to carry out the functions necessary to (1) obtain the degree of treatment provided by the plant design, and (2) maintain and protect the community's investment in the physical plant. Even the simplest treatment plant will not operate continuously or for long without supervision. As would be expected, the needs for more personnel and personnel with more complex training increase with the size of the facility as well as the degree of treatment for which the plant has been designed.

The only satisfactory and sure way to measure the degree of treatment being obtained is by adequate laboratory control. There are many procedures used to measure plant performance. They range from quite simple tests requiring only limited equipment and instructions to complex examinations requiring elaborate equipment and considerable training to perform the tests and interpret the results. The procedures recommended here are intended to be consistent with the personnel recommended for the various sizes of treatment facilities and are intended to fit the minimum requirements found necessary for the control of these works.

The third operating component discussed in detail here is the keeping of records. The need for accurate and readily understandable records is necessary for local and State supervision. They also are valuable in guiding the operating personnel toward locating and solving operating problems. They comprise the only proof of performance and serve to justify decisions, expenditures, and recommendations. They provide valuable information for release to customers and the public and are critical documents in the event of any legal action. Training, experience, and consultation with others will further emphasize the value of well-kept records.

Certain assumptions necessarily were used as guides in developing these recommendations. All recommendations are basic minimum proposals and should be adjusted or expanded as the needs dictate. In the laboratory procedures the suggested tests are intended to deal with a normal domestic wastewater treatment plant with no unusual industrial waste or raw wastewater pumping problems. A wastewater contribution of 100 gallons per capita per day was chosen to establish a relationship between plant capacity and population. In addition to the standard tests, several techniques used by operators as aids to plant control are also described.

Consideration was given to the amount of time operating personnel can be allowed for making the tests and for operating and maintaining the treatment plant. This is necessary to prevent an undue economic burden on a community. The suggestions on time required for operation of the various size plants are based on studies of existing practice. The number of operators or laborers may need to be increased because of local conditions or other requirements.

To outline these minimum recommendations, it was necessary to select several kinds and sizes of plants to represent the most prevalent conditions of the size of the community being served. These were arbitrarily selected and represent a cross section of the majority of plants now in operation or expected to be placed in operation. The capacities selected were 0.25, 0.5, 1.0, 5.0, and 10.0 MGD, and based on the assumed per capita wastewater contribution, correspond to populations of 2,500, 5,000, 10,000, 50,000, and 100,000, respectively. For communities having populations and/or design conditions between the selected sizes (for example, a 0.75 MGD plant), qualified interpolation of the recommendations will be necessary. Qualified in this instance means that the exact requirements should be somewhere within but not necessarily precisely proportionate to the recommendations for the plants immediately larger and smaller. Where judgment is necessary, a tendency toward the recommendations for the larger plant is desirable.

Recommendations for personnel, laboratory control, and records follow for each plant size selected.

PLANT CAPACITY 0.25 MGD

Personnel

Very small communities seldom can afford more than a half-time or, at best, a single full-time operator at the plant during the normal five-day work week. A minimum of one to two hours should be provided on Saturdays, Sundays, and holidays for sludge pumping, equipment inspection, and minimum operational attendance. Much of the operator's time will be required for routine operation of the treatment works and equipment maintenance. Time should be available, however, to perform minimum tests and keep necessary records. Two hours per week should be sufficient for the tests and record keeping at primary plants. An estimated five hours a week will be required at secondary treatment plants.

Laboratory Control

In a plant of this size, the operator should conduct the following tests:

(1) Settleable solids (Imhoff Cone) once or twice a week using grab samples. The grab samples should be taken at a time of representative flow and should reflect varying days of the week and hours of the day.

(2) Relative stability (methylene blue) daily, Monday through Friday.

(3) Chlorine residual of effluent daily, Monday through Friday; twice daily when stream conditions require.

(4) For activated sludge plants, in addition to the above tests, sludge index tests daily and a colorimetric dissolved oxygen test weekly.

Records

Usually personnel and time limitations will permit the keeping of only minimal records. However, two types of records should be kept: (1) a diary-type log showing a necessarily wide variety of useful and important information such as unusual maintenance work, failure of a piece of equipment, accidents, unusual weather, flooding, bypassing, complaints, visitors, etc.; and (2) a tabular record showing the observation or results of each laboratory test made and other available measured data such as plant flow, volume of sludge, or time sludge pumped. Emphasis is placed here on the need for the operator to record the data available to him with strict regularity and in a form best suited to his schedule.

PLANT CAPACITY 0.5 MGD

Personnel

A community of this size should be able to provide at least one full-time operator and one half-time laborer. With an activated sludge plant, the laborer should be full-time. A plant of this size (other than activated sludge) probably will require about five hours a week to keep records and carry on the laboratory control procedures. In an activated sludge treatment plant, the time required would increase to eight hours a week.

Laboratory Control

For a plant other than activated sludge the following tests should be conducted:

(1) Settleable solids (Imhoff Cone) daily, Monday through Friday. Tests should be made at varying hours during the day.

(2) Relative stability (methylene blue) daily, Monday through Friday. Tests should be made at varying hours during the day.

(3) Colorimetric pH of raw waste water occasionally.

(4) Chlorine residual of effluent daily; twice daily when stream conditions require.

(5) Total solids of digested sludge occasionally and when the sludge is drawn to the drying beds.

(6) pH of digested sludge occasionally and when the sludge is drawn to the drying beds.

For an activated sludge plant the following tests should be conducted:

(1) Settleable solids (Imhoff Cone) daily.

(2) Relative stability (methylene blue) daily.

(3) Sludge index daily.

(4) Mixed liquor dissolved oxygen (colorimetrically) daily.

(5) Sludge depth measurements in primary and secondary settling tanks daily.

(6) pH of digested sludge when sludge is drawn.

(7) Total solids of digested sludge when sludge is drawn.

Records

A diary should be kept similar to the 0.25 MGD plant, but with a full-time operator it should be more comprehensive. Regularity is emphasized.

The laboratory control record also is slightly more detailed because of the additional tests specified and with a full-time operator should be maintained with ease. Consultation with State regulatory agency representatives, university personnel, and/or other experienced personnel, and attendance at short courses in his State will assist the operator to establish and maintain suitable records. These records should be accurate and complete for the items specified. Time and funds should be made available to allow the operator to attend short schools, operator meetings, and to obtain necessary books and periodicals. Membership in organizations concerned with wastewater treatment problems should be encouraged.

PLANT CAPACITY 1.0 MGD

Personnel

A 1.0 MGD plant should have six hours per week of administrative supervision, two operators, and one laborer.

For primary and trickling filter plants approximately 15 hours a week will be needed for record keeping and laboratory tests. For activated sludge plants the time required for record keeping and testing will increase to approximately 20 hours per week so that sufficient time is allowed for the added control procedures.

Laboratory Control

For primary and trickling filter plants the following tests are specified:

(1) Settleable solids (Imhoff Cone) daily.

(2) Relative stability (methylene blue) daily.

(3) BOD's of raw waste, final effluent, and of such other components as possible once a week and preferably twice a week. Samples should be 3-hour composites taken at 11 a.m., 12 noon, and 1 p.m.

(4) Suspended solids of raw waste, final effluent and of such other components as possible once a week and preferably twice a week. Samples should be 3-hour composites taken at 11 a.m., 12 noon, and 1 p.m.

(5) pH of digested sludge when drawn or when operating difficulties are experienced or anticipated.

(6) Total solids of digested sludge when drawn or when operating difficulties are experienced or anticipated.

(7) DO of receiving stream at least twice a week above and below the plant discharge.

(8) Chlorine residuals of effluent daily; twice daily, when stream conditions require.

For activated sludge plants the following tests are specified:

(1) Settleable solids (Imhoff Cone) daily.

(2) Relative stability (methylene blue) daily.

(3) BOD's of raw waste, final effluent, and of such other components as possible twice a week. Samples should be 3-hour composites taken at 11 a.m., 12 noon, and 1 p.m.

(4) Suspended solids of raw waste, mixed liquor, and final effluent once a week. Samples should be 3-hour composites taken at 11 a.m., 12 noon, and 1 p.m.

(5) pH of digested sludge when drawn or when operating difficulties are experienced or anticipated.

(6) Total solids of digested sludge when drawn or when operating difficulties are experienced or anticipated.

(7) Depth of sludge in primary and final settling tanks daily.

(8) Sludge index daily.

(9) Dissolved oxygen (colorimetric) of mixed liquor daily.

(10) DO of receiving stream at least twice a week above and below the plant discharge.

(11) Chlorine residual of effluent daily; twice daily, when stream conditions require.

Records

For a plant of this size considerable care and technical competence is required in assembling and recording the data. Included in the supervision should be the understanding and patience needed to interpret the control procedure carried on. To establish and maintain adequate records, some guidance will be needed from State regulatory agency representatives, university personnel, and/or other experienced individuals. Time and funds should be made available to allow the operator to attend short schools, operator meetings, and to obtain necessary books and periodicals. Membership in organizations concerned with wastewater treatment problems should be encouraged.

PLANT CAPACITY 5.0 MGD

Personnel

A 5.0 MGD plant should have 24-hour attendance with a superintendent, 4 operators, 1 maintenance man, and 1 laborer. Approximately 40 hours per week should be devoted to records and laboratory control. For activated sludge plants it would be well to add 1 chemist and 1 additional laborer to the staff.

Laboratory Control

Following are recommended test procedures for plants other than activated sludge:

(1) Settleable solids daily.

(2) Relative stability daily.

(3) Dissolved oxygen of raw waste, effluent and receiving stream above and below the plant discharge 5 days per week.

(4) pH of raw waste and effluent 5 days per week.

(5) BOD's of raw waste and effluents 3 times per week on 24-hour composite samples.

(6) Suspended solids of raw waste and effluents 3 times per week on 24-hour composite samples.

(7) pH of digested sludge when drawn or as necessary to control digester operation.

(8) Total and volatile solids of digested sludge when drawn or as necessary to control digester operation.

(9) Volatile acids of digested sludge when drawn or as necessary to control digester operation.

(10) Chlorine residual of effluent daily, twice daily when stream conditions require.

For activated sludge plants the recommended test procedures are as follows:

(1) Settleable solids daily.

(2) Relative stability or nitrates 5 days per week on 24-hour composite samples.

(3) Dissolved oxygen of raw waste, effluent and receiving stream above and below discharge 5 days per week.

(4) pH of raw waste and final effluent daily.

(5) BOD's of raw waste and effluents 5 days per week on 24-hour composites.

(6) Suspended solids of raw waste and effluents 5 days per week on composite samples.

(7) Sludge index daily on each shift.

(8) Mixed liquor DO (colorimetric) daily on each shift.

(9) Sludge depth in primary and final settling tanks daily on each shift.

(10) pH of digested sludge when drawn or as needed to control digester operation.

(11) Total and volatile solids of digested sludge when drawn or as needed to control digester operation.

(12) Volatile acids of digested sludge when drawn or as needed to control digester operation.

(13) Chlorine residual of effluent daily, twice daily when stream conditions require.

Records

The size of this plant makes it desirable to keep daily records of all operations - many of them on a shift basis. With a full-time superintendent and a staff of trained men, including a chemist in an activated sludge plant, there should be no difficulty in maintaining the records in a highly competent manner. The specified personnel should secure the interpretation and use of the control information in such a way as to obtain the maximum treatment efficiency.

Since this falls in the large plant category there may be considerable flexibility in the form of records and various control procedures. In addition to the recorded laboratory control and diary-type log information, this plant may need to record a number of other determinations. Some of these might include alkalinity, ORP, heavy metals, or certain components indicative of particular industrial waste problems.

Time and funds should be made available to allow the superintendent and operators to attend short schools, operator meetings, and to obtain necessary books and periodicals. Memberships in organizations concerned with wastewater treatment problems are desirable.

There are frequent needs to record other information which contributes markedly to the control procedure. Some of these data include the following:

(1) Weather and wind direction in the event of odor problems.

(2) In addition to the raw waste flow, a record of bypassing.

(3) Amount of course solids handled; i.e., grit screening, dried sludge hauled from beds, or sludge removal from digesters.

(4) Primary and secondary settling tank cleanup - hours of hosing or skimming and/or maintenance, etc.

(5) Trickling filter maintenance - nozzle cleaning, dosing or recirculating pump operation, humus sludge pumping to primary tanks, etc.

(6) Activated sludge operation - air volume and blower operation, volume of sludge return and waste, replacement or cleaning diffusers, etc.

(7) Sludge handling - in addition to volume of sludge pumped and time, such information as amount of recirculation or transfer of digested sludge, gas mixing, supernatant withdrawal, final sludge to drying beds or filters disposal of sludge from beds, conditioning chemicals for filters, incineration, etc.

Records of the above operations may be kept in a form most convenient to the superintendent. Because of the wide variation in plants of this size and individual needs, the way these records are kept will vary considerably.

PLANT CAPACITY 10.0 MGD

Personnel

A 10.0 MGD plant should have a superintendent, a chemist, 6 operators, a maintenance man, and 2 laborers. A plant of this size should be completely staffed and conduct all tests needed for operation and industrial wastes studies.

Laboratory Control

Required test procedures for plants other than activated sludge are:

(1) Settleable solids daily.

(2) Relative stability daily.

(3) Dissolved oxygen of raw waste, effluent and receiving stream above and below discharge 5 days per week.

(4) pH of raw waste and effluent daily.

(5) BOD's of raw waste and effluents daily, Monday through Friday, based on 24-hour composite samples.

(6) Suspended solids of raw waste and effluents daily, Monday through Friday, based on 24-hour composite samples.

(7) pH of digested sludge when drawn or as needed to control digester operation.

(8) Total and volatile solids of digested sludge when drawn or as needed to control digester operation.

(9) Volatile acids of digested sludge when drawn or as needed to control digester operation.

(10) Chlorine residuals of effluent daily, twice daily when stream conditions require.

For an activated sludge plant the required test procedures are:

(1) Settleable solids daily.

(2) Relative stability or nitrates daily on 24-hour composite samples.

(3) Dissolved oxygen of raw waste, final effluent and receiving stream above and below discharge 5 days per week.

(4) pH of raw waste and final effluent daily.

(5) BOD's of raw waste and effluents daily, Monday through Friday, on 24-hour composite samples.

(6) Suspended solids of raw waste and final effluents daily, Monday through Friday, on 24-hour composite samples.

(7) Sludge index daily on each shift. Solids should be determined in conjunction with the BOD and suspended solids determinations.

(8) Mixed liquor DO (colorimetric) daily on each shift.

(9) Sludge depth in primary and final settling tanks daily on each shift.

(10) pH of digested sludge when drawn or as needed to control digester operation.

(11) Total and volatile solids of digested sludge when drawn or as needed to control digester operation.

(12) Volatile acids of digested sludge when drawn or as needed to control digester operation.

(13) Chlorine residual of effluent daily, twice daily when stream conditions require.

Records

The comments on records for the 5.0 MGD plant also apply to the 10.0 MGD plant. The administrative personnel should select the record style best suited to their specific needs. Many more items of control data also may be desirable, based on the superintendent's judgment and on special conditions.

With a larger staff the 10.0 MGD plant may be able to carry on special projects beyond that possible in the smaller plants. Such projects may include special studies on industrial wastes or operational research projects. These projects may result in published information which can be valuable to many others with similar problems.

A plant of this size normally is expected to produce an annual operating report containing comprehensive records of the year's activities and performance. This procedure enables the superintendent to transform the daily records into summary and unusual information which is quite helpful to others.

DISCUSSION

Laboratory Control and Personnel

It is emphasized that all recommendations for laboratory analyses and personnel are minimum. When special problems such as industrial wastes exist, where the availability of trained personnel permits, or when special treatment standards are required, it may be advisable or necessary to amend the recommendations toward more detailed control. Consultation with the responsible State agency or other applicable control agency will determine the extent of these requirements.

The same controlling factors will determine personnel needs in excess of those recommended. There may be instances where local conditions, special pumping requirements, or special treatment problems will make it necessary to increase the staff, by utilizing additional operators, chemists, and/or laborers.

In addition to consultation with individuals and use of available published information, the superintendent and/or operator will find the short courses offered in his State of great benefit. From these courses come much of the fundamental information and detailed assistance most valuable to the operator in carrying out his daily job. Membership in and attendance at meetings of organizations concerned with wastewater treatment problems also are integral to the operating personnel's best performance. Regular use of comprehensive guides for operating practice is strongly recommended. By using such references the operator may take advantage of the experiences of many others with similar problems.

There are several general comments on laboratory control which are considered both explanatory and pertinent to the sound application of the minimum recommendations. These include:

(1) The settleable solids test using the Imhoff Cone is the basic control test and in many respects is the most valuable of all. Its simplicity and ease of interpretation make it suitable for the smallest plant. By a visual indication a ready comparative evaluation of a plant's performance may be obtained. Daily use is highly desirable where possible.

(2) The relative stability test using methylene blue is recommended for trickling filters and even for activated sludge because of its simplicity and its indication of nitrates in the final effluent. The relative degree of stabilization of the wastewater is thus apparent.

(3) Where sludge digester capacity is limited, pH, volatile acids, and alkalinity should be determined as often as necessary to control digester operation.

(4) Because of the time involved in conducting the tests, the frequency of determining BOD's and suspended solids of the raw waste, settled waste, and final effluent is limited to the recommendations of once or twice a week for the 1.0 MGD plant to 5 days a week for the 10.0 MGD plant. More frequent determinations for the smaller plant are desirable if possible.

(5) For activated sludge control there should be frequent tests for depths of sludge blanket, not only in final settling tanks, but also in primary tanks, because of the importance of solids control in the aeration tanks. These measurements also may be used with equal success to control sludge pumping from primary tanks or return and wasting of sludge from activated sludge final settling tanks.

(6) For controlling dissolved oxygen in the mixed liquor, the operator may collect the sample (fixed by copper sulfate solution), settle and siphon off a clear sample into a 4-oz. bottle, add manganous sulfate, alkali, and acid, and compare the yellow iodine color with color standards made with $K_2C_2O_7$ and $CoCl_2$; 0.5, 1.0, 4.0, and 6.0 mg/l. This is a control test - not a precise laboratory titration, but is valuable for rapid control.

(7) When making the mixed liquor settling test, the volume settled at both 5-min. and the 30-min. interval should be recorded. If the sludge volume index is 100 or less the solids level at the 5-min. time will be about twice the level at 30-min. settling. As the sludge volume index rises above 100 the 5-min. settling will show a level considerably more than twice the 30-min. level. By this means a rough approximation of an index above 100 indicates the approach of operating difficulty.

Records

The need for regular and accurate records is outlined earlier in the recommendations. The records outlined here also are minimum recommendations. Obviously, the smallest plant cannot be expected to keep an elaborate set of records; however, it is far more useful to have excess information than none.

The operator should learn to record the observations and data available to him in the most orderly manner possible. Many of the smaller plants record all information in a log book, others on tabular sheets. As the size and complexity of the plants increase many find it desirable to organize the records into separate sheets for treatment components, such as preliminary and primary treatment, trickling filters, activated sludge units, final settling, sludge handling, laboratory records, etc. Experience and guidance from State regulatory agencies, university personnel, published information, and other individuals and organizations will assist the operator in adopting the physical type of records best suited to his particular needs. Above all, he should be faithful in recording the information available to him.

Adopted by the Conference of State Sanitary Engineers at their 38th Annual Meeting
June 1963

EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL ON ENVIRONMENTAL QUALITY
WASHINGTON, D. C. 20575

MAR 13, 1970

Dear Mr. Voss:

Thank you for your letter of March 2, 1970, attaching the General Accounting Office's proposed report to the Congress on the need for approved operation and maintenance of municipal waste treatment plants.

Your report represents a most thorough effort on an important subject. No matter what level of funds are made available for the construction of new treatment facilities, we cannot achieve our water pollution control goals unless these and existing plants are properly operated and maintained.

As your report notes, the President's message on the environment recognized the problem of poor design, and operation and maintenance of waste treatment facilities. The President's message indicated that Federally assisted treatment plants would be required to meet prescribed design, operation and maintenance standards, and be operated by State-certified operators. Those regulations discussed in the message would also require industrial pre-treatment of waste. We believe the President's recommendations, coupled with some of the additional recommendations made by the General Accounting Office, will help achieve a better investment of Federal, State and local funds and higher levels of water quality.

We thank you for this opportunity to comment on your report.

Sincerely,

Russell E. Train
Chairman

Mr. Allen R. Voss
U.S. General Accounting Office
Washington, D.C. 20548

United States Department of the Interior
OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

APR 9, 1970

Mr. Allen R. Voss
Associate Director, Civil
Division
General Accounting Office
Washington, D. C. 20548

Dear Mr. Voss:

The Department of the Interior has reviewed your draft report to the Congress entitled "Need for Improved Operation and Maintenance of Municipal Waste Treatment Plants, Federal Water Pollution Control Administration, Department of the Interior and is in substantial agreement with its findings. Included in the report are references to Departmental actions underway that are directed toward improving the operation and maintenance of waste treatment plants.

Attached is a copy of a proposed amendment of 18 CFR Part 601 appearing in the March 31, 1970, Federal Register. We are confident that 18 CFR Part 601.35 Inspections will further strengthen the Commissioner's authority to initiate solutions to the operation and maintenance problems cited on page six of your report.

We appreciate the opportunity to have reviewed the report in draft.

Sincerely yours,

J. J. Hall Jr.
Director of Survey and Review

Enclosure

Proposed Rule Making

DEPARTMENT OF THE INTERIOR

Federal Water Pollution Control Administration

[18 CFR Part 601]

GRANTS FOR CONSTRUCTION OF TREATMENT WORKS

Notice of Proposed Rule Making

Notice is hereby given that the Secretary of the Interior pursuant to the authority in sec. 6, 70 Stat. 502, as amended; 33 U.S.C. 466e, proposes to amend Subpart B of Part 601 by adding five new sections to that subpart, and by amending one of the sections in that subpart.

The proposed amendments are intended to provide greater assurance that treatment works for which Federal financial assistance is provided under this subpart will more effectively enhance and improve the quality of the water into which such treatment works will discharge. To achieve this greater assurance, the Commissioner proposes to require: That treatment works be included in a basin-wide plan for pollution abatement; that the treatment works be included in a metropolitan or regional plan for pollution abatement; and that the treatment works be operated in conformance with requirements relating to the treatment of industrial waste; and that such treatment works be designed and periodically inspected so as to achieve efficiency, economy, and effectiveness.

Interested persons may submit in triplicate, written data, views or arguments in regard to the proposed regulations to the Secretary of the Interior, Washington, D.C. 20240. All relevant material received not later than 45 days after publication of this notice will be considered.

Subpart B would be amended by adding the following new sections, as follows:

§ 601.32 Basin control.

(a) No grant shall be made unless the Commissioner determines, based on information the State, or where appropriate, the interstate agency for the areas within their respective jurisdictions, furnishes to him pursuant to paragraph (b) of this section that a project is included in an effective basin-wide program for pollution abatement.

(b) In reaching such determination, the Commissioner may require information in such manner as he prescribes concerning the total basin program, or portion thereof, as he deems adequate to evaluate the effectiveness of the project. Such information shall be furnished within 1 year of the date of the Commissioner's request for such information. The Commissioner may extend this period for proper cause. For this purpose, the affected river basin waters shall be deemed not to include any waters outside the State in which the project is located but shall include waters in another State if an interstate agency has jurisdiction of the additional affected basin waters.

(1) *Sources of pollution.* An identification list of all significant waste discharges: municipal, industrial, agricultural and others.

(2) *Volume of discharge.* The average daily volume of discharge produced by each waste discharger. Cooling water, or cooling water which is contaminated by industrial waste or sewage shall be reported separately. Storm water and runoff and mixed storm water and sewage shall be identified and reported separately.

(3) *Character of effluent.* The major characteristics of each such waste discharge together with a measurement of their relative strength or concentrations, including but not limited to:

BOD 5	mg/l.
Color	Platinum cobalt scale.
Turbidity	Jackson candle scale.
Solids	mg/l.
Toxic substances	—
Metal ions	mg/l.
Fluorides	mg/l.
Dissolved substances	ppm.
Temperature	C°.
pH	—
Radioactivity	Ci/l.
Chlorides	mg/l.
Nutrients	mg/l.

(4) *Present treatment.* A brief description of the type of treatment being given by each discharger, together with a statement of the degree of treatment currently being achieved.

(5) *Water quality effect.* A brief description of the effect of discharges and abatement practices upon the quality of the water in the basin, and the anticipated effectiveness of the proposed project in improving the quality of the water.

(6) *Detailed abatement program.* Identify all waste discharges for which present treatment is less than required by standards, or which will degrade water quality below standards. For each such discharger so identified, furnish an abatement schedule containing the following:

(i) Level of treatment to be required expressed in percentage of reduction of BOD and any other significant parameters required pursuant to applicable Federal, State, and interstate laws, regulations and orders.

(ii) Volume of flow for which waste treatment facilities will be designed.

(iii) Estimated completion dates for preliminary plans, for final design, for construction, and for operation of waste treatment facilities.

(iv) Estimated cost of design and construction if available.

(c) If the proposed project is not included in an effective basin-wide program for pollution abatement, and the Commissioner determines that such project will nevertheless effectively contribute to the improvement of the quality of the water in the basin, he may waive the limitation of paragraph (a) of this section. In making his determination the Commissioner may require all or a part of the information identified in paragraph (b) of this section.

(d) The Commissioner's discretion in determining the desirability of any project shall not be limited by any provision of any basin-wide abatement program pursuant to this section.

§ 601.33 Regional and metropolitan plan.

(a) A grant for a project shall not be made unless the Commissioner determines that such project is included in an effective metropolitan or regional plan developed or in the process of development, and certified by the Governor as being the official pollution abatement plan developed or in the process of development for the metropolitan area or region within which the project is proposed to be constructed.

(b) In reaching such determination the Commissioner shall consider whether such plan adequately takes into account: anticipated growth of population and economic activity with reference to time and location; present and future use and value of the waters within the planning area for water supplies, propagation of fish and wildlife, recreational purposes, agricultural, industrial and other legitimate uses; adequacy of the waste collection systems in the planning area with reference to operation, maintenance and expansion of such systems; combination or integration of waste treatment facilities into a waste treatment system so as to achieve efficiency and economy of such treatment; practicality and feasibility of treating domestic and industrial waste in a combined waste treatment facility or integrated waste treatment system; need for and capacity to deal with waste from sewers which carry storm water or both storm water and sewage or other wastes; waste discharges presently in, or anticipated for the planning area; effect of the proposed waste treatment facility upon the quality of the water within the planning area with reference to other waste discharges and to applicable water quality standards.

(c) If the proposed project is not included in an effective metropolitan or regional plan for pollution abatement, and the Commissioner determines that such project will nevertheless effectively contribute to the improvement of the quality of the water in the metropolitan area or region, he may waive the limitation of paragraph (a) of this section. In making his determination the Commissioner may require all or a part of the information identified in paragraph (b) of this section.

(d) The Commissioner's discretion in determining the desirability of any project shall not be limited by any provision of any metropolitan or regional plan pursuant to this section.

§ 601.34 Industrial waste treatment.

(a) No grant shall be made for any project if such project is included in a waste treatment system, determined by the Commissioner to be intended to treat industrial waste, rather than the wastes of the entire community, metropolitan area, or region concerned. For purposes of this section "waste treatment system" means one or more treatment works which provide integrated waste disposal for a community, metropolitan area or region.

(b) If industrial waste is to be included in the waste treated by the proposed project, the applicant shall assure the Commissioner that such applicant will require pretreatment of industrial waste which would if untreated be detrimental to the treatment works or its proper and efficient operation and maintenance, or will otherwise prevent the entry of such waste into the treatment plant.

(c) Where industrial wastes are to be treated by the proposed project the applicant shall assure the Commissioner that it has, or will have in effect when the project will be operated, an equitable system of cost recovery. Such system of cost recovery may include user charges, connection fees or such other techniques as may be available under State and local law. Such system shall provide for an equitable assessment of costs whereby such assessments upon dischargers of industrial wastes correspond to the cost of the waste treatment, taking into account the volume and strength of the industrial, domestic, commercial wastes and all other waste discharges treated, and techniques of treatment required. Such cost recovery system shall produce revenues, in proportion to the percentage of industrial wastes, proportionately, relative to the total waste load to be treated by the project, for the operation and maintenance of the treatment works, for the amortization of the applicant's indebtedness for the cost of such treatment works, and for such additional costs as may be necessary to assure adequate waste treatment on a continuing basis. For purposes of this section "industrial waste" shall mean the waste discharges (other than domestic sewage) of industries identified in the Standard Industrial Classification Manual, Bureau of the Budget, 1967, as amended and supplemented, under the category "Division D—Manufacturing," and such other wastes as the Commissioner deems appropriate for purposes of this section.

§ 601.35 Inspections.

No grant shall be made for any project unless the applicant assures the Commissioner that the State Water Pollution Control Agency will inspect the treatment works not less frequently than annually for the 3 years after such treatment works are constructed and periodically thereafter to determine whether such treatment works are operated and maintained in an efficient, economic and effective manner, and in accordance with such requirements as the Commissioner from time to time may publish concerning methods, techniques and practices for economic, efficient and effective operation and maintenance of treatment works.

§ 601.36 Design.

No grant shall be made for any project unless the Commissioner determines that the proposed treatment works are designed so as to achieve economy, efficiency and effectiveness in improving the quality of the water into which such treatment works will discharge; and that the applicant will meet such requirements as the Commissioner may publish from time to time concerning treatment works design so as to achieve efficiency, economy and effectiveness in waste treatment.

§ 601.25 [Amended]

Subpart B would be further amended by adding to subsection (c) of § 601.25 a new subparagraph (3) as follows:

(3) Such project is included in a basin-wide program for pollution control in accordance with § 601.32, and such project is included in a metropolitan or regional plan for pollution abatement in accordance with § 601.33 of this Subpart.

Subpart B would be further amended by renumbering the existing subparagraph (3) of § 601.25(c) as subparagraph (4), and by changing the reference to subparagraph (3) in the proviso following such subparagraph (3) to subparagraph (4).

Dated: March 24, 1970.

WALTER J. HICKEL,
Secretary of the Interior.

[F.R. Doc. 70-3812; Filed, Mar. 30, 1970; 8:47 a.m.]

STATE of INDIANA

STREAM POLLUTION CONTROL BOARD

INDIANAPOLIS 46206

1330 West Michigan Street
[illegible]

March 26, 1970

United States General Accounting Office
Civil Division
Washington, D. C. 20548

Attention: Mr. Allen R. Voss
Associate Director

Gentlemen:

Re: Proposed Report to the Congress, Need for Improved Operation and Maintenance of Municipal Wastewater Treatment Plants

This acknowledges your letter of March 2, 1970, together with an enclosed copy of subject report.

The report notes that to a large degree the plants are not meeting the "Recommendations for Minimum Personnel, Laboratory Control, and Records for Municipal Waste Treatment Works" (Appendix III of the report). The State of Indiana has not adopted the "Recommendations" as requirements but does consider them as a useful guide; efforts are being made to obtain adequate operation and maintenance at all plants.

The data on Indiana plants covered by the report are considered essentially factual at the time of the investigations; however, improvements to these facilities have since been made. We believe the improvements can be attributed to the requirements and insistence of this office that the municipalities proceed with improvements necessary to provide a satisfactory effluent to meet Water Quality Standards in the receiving waters.

The report indicates that requirements for insuring efficient operation and maintenance were limited at the time the Federal construction grants were being considered. The Stream Pollution Control Board has established Water Quality Standards and has the authority to enforce abatement of pollution sources. The Certification Act of 1967 implemented by the State Board of Health provides that all sewage treatment plants in the State will be operated by a certified operator. This provides additional means of obtaining effective operation and maintenance. This Act also requires industrial waste plants to have certified operators; industry has recently shown a marked improvement in their cooperation. The certification program is slowed by a shortage of qualified personnel.

This Board has sponsored on-the-job training under a National Contract. The Indiana Vocational Technical College is presently providing this training in a 44-week school for a total of 88 students at four locations throughout the State. This plus other training offered will help meet the need for additional qualified operators.

This office generally concurs with the "Recommendations" proposed on page 12 and 13. We believe the states are in the best position to control the operation and maintenance of municipal wastewater treatment plants.

Very truly yours,

B. A. Poole

B. A. Poole
Technical Secretary

JCKrieger/lbl

KENTUCKY
WATER POLLUTION CONTROL COMMISSION
275 EAST MAIN STREET
FRANKFORT, KENTUCKY 40601

April 7, 1970

Mr. Allen R. Voss
Associate Director
United States General Accounting Office
Washington, D.C. 20548

Dear Mr. Voss:

Re: Review of draft copy of GAO report on "Need for Improved Operation and Maintenance of Municipal Waste Treatment Plants.

It must be understood that the following remarks apply only to that portion of the report which pertains to the Commonwealth of Kentucky because that is the only area in which we are qualified to speak.

The staff of the Kentucky Water Pollution Control Commission was happy to have the opportunity to review the above referenced report. This office has long been aware of the need for improved operation and maintenance in waste treatment facilities. Qualified operators are necessary to properly operate and maintain a waste treatment plant and the GAO report is correct when it states that waste treatment plant operators' pay, prestige and training must be upgraded before the shortage of qualified operators can be overcome.

There are several aspects of this report that are very disturbing to this office because it appears that the facts have been distorted.

1. In Kentucky fifteen plants were selected, their records thoroughly reviewed and visits to each of the fifteen plants in Kentucky were made jointly by representatives of GAO and this office. Of the fifteen plants visited, the two plants experiencing difficulty in producing a satisfactory effluent were selected to be thoroughly

discussed in the GAO report, leaving the impression that all plants in Kentucky were not producing an effluent whose quality was sufficient to protect the receiving stream. Why is it the GAO report did not mention that in the opinion of our engineers thirteen of the plants in Kentucky were producing a satisfactory effluent which did protect the receiving streams? In other words, the effluent quality of the thirteen plants we are speaking of was the quality for which the plant was designed to produce.

2. One of the Kentucky plants mentioned in the report as being unsatisfactory was at the time of the GAO visit being investigated by this Commission to determine what legal action would be required to get the plant in proper operation. This fact was brought to the attention of the GAO investigators.

3. On Page 34 of the draft, a portion of a State report has been quoted. That portion dealing with the deterioration of the plant speaks mainly to that portion constructed in 1939 as a WPA project and not the expanded facilities of 1965.

4. In addition to the operator training courses listed in the report, Kentucky has conducted individual training sessions for laboratory procedures on an as needed basis. Also Kentucky does have a national contract from the FWPCA to upgrade forty plant operators through a 44 week training course being conducted in Lexington, Kentucky.

The other example from Kentucky listed in the report in detail was bypassing for no legitimate reason. This situation has been corrected.

The report does not bring out in significant detail the fact that the primary function of the waste treatment plant is to produce an effluent that will protect the receiving stream. Kentucky law dictates that each plant will have at least one certified operator and that the effluent will meet the design requirements of the plant. If the effluent is satisfactory, legal action cannot be taken regardless of how few or how many people are operating the treatment plant if the plant has at least one certified operator. Kentucky does have the capability of determining whether a plant is functioning properly. The staff of the Kentucky Water Pollution Control Commission does have the expertise to help plant operators solve unusual operating problems.

In summary let us point out again that of the fifteen plants visited in Kentucky, thirteen were producing satisfactory effluents in the opinion of state engineers accompanying GAO inspectors. Two plants were not and these were the two covered in great detail in the report. If this same policy was applied to the other states under review then to say the picture is distorted is putting it mildly. A layman reading this report would assume that the money spent on these projects was wasted and no real benefit to the improvement of water quality in the states under review had been accomplished by the building of these treatment plants. We doubt seriously that this is the case and we do not believe that this is the impression that the GAO report intended to create.

Very truly yours,

Ralph C. Pickard, Executive Director
Water Pollution Control Commission

State of Montana

State Department of Health

JOHN S. ANDERSON, M.D.
EXECUTIVE OFFICER

HELENA, MONTANA

March 20, 1970

Mr. Allen R. Voss
Associate Director
U. S. General Accounting Office
Washington, D. C. 20548

Dear Mr. Voss:

Mr. Brinck is on vacation until March 23, 1970, so I will take the liberty of reviewing and commenting on the report, "Need for Improved Operation and Maintenance of Municipal Waste Treatment Plants."

Regarding the comments on Example 9 (Montana-51,820) a secondary treatment plant precedes the lagoon. The lagoon is considered tertiary treatment when the secondary is functioning properly (page 42). On page 44, a statement is made that none of the above mentioned problems had been corrected. The moat problem was corrected before that date. They now recognize that some maintenance must be done on the moats. A comminutor will probably be installed in 1971, with hopefully, a temporary screen for 1970. Another city has offered to sell the comminutors from their existing plant for $500 when their waste treatment plant is completed in late 1970.

There are quite a few comments in the report regarding operators. I would caution against any general public statements regarding operators. In Montana, it has taken us about ten years to obtain some sort of status for operators. In reading the newspapers in Montana, it would appear that no one is doing their job as far as treatment is concerned as only poor examples are cited. This isn't the case in the majority of our plants. Operator morale has taken a beating and the pride of some in doing a good job, I'm sure, is being affected. The good ones need a pat on the back and should not be hurt by a general statement that operation needs to be improved. I wish you had the opportunity to inspect some of the good ones in Montana.

We recognize that operation and maintenance need to be improved at some plants, and your report is an attempt to provide better operation and maintenance; but let's not hurt the good ones in the process.

Thanks for the opportunity to review the report.

Sincerely yours,

D. G. Willems

D. G. Willems, P.E., Chief
Water Pollution Control Section
Division of Environmental Sanitation

DGW:sdd

DEPARTMENT OF
ENVIRONMENTAL QUALITY

STATE OFFICE BUILDING • 1400 S.W. 5th AVENUE • PORTLAND, OREGON • 97201

TOM McCALL
GOVERNOR
KENNETH H. SPIES
Director
ENVIRONMENTAL QUALITY
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Portland
GEORGE A. McMATH
Portland

March 25, 1970

Mr. Allen R. Voss
Associate Director
U. S. General Accounting Office
441 "G" Street, N.W.
Washington, D. C. 20548

Re: S-1 Sewage Treatment, General

Dear Mr. Voss:

We have received and reviewed the report entitled "Need for Improved Operation and Maintenance of Municipal Waste Treatment Plants."

This agency has long been aware of the need for improved operation and maintenance of sewage treatment plants. The report contains no new information on this subject. It has been the policy of this Department for many years to provide assistance through operator training schools, certification, and plant inspections to upgrade the operation and maintenance programs of all sewerage works facilities located in the state. It is our intention to continue with this effort. Ten of the eleven elements cited as being present in the more successful state programs have already been initiated in this state.

The two examples of inadequate operation and maintenance programs cited from this state are in no way typical of the programs to be found in most of the other 250 plants. This is not to say that operation and maintenance problems are not found in other plants, because the plant has not yet been built that will not have some operational difficulties. The important point is whether anything is being done about the problems that do arise. One point which the investigators seemed to overlook is that the biological treatment processes used in the sewage plant do not lend themselves to absolute quality control such as may be attained in some types of manufacturing processes. It is therefore possible to find that the quality of effluent from these plants may vary from time to time. The occurrence of this does not constitute a complete breakdown of the operation and maintenance program.

Please be assured, however, that this agency will continue its effort to provide the best possible treatment of all wastes before

Re: S-1 Sewage Treatment, General
March 25, 1970
Page 2

they are discharged to the receiving waters of the state. We intend to cooperate fully with all agencies who share this responsibility. Among our objectives will be the continued upgrading of operator skills and the promotion of adequate operating budgets at the local level.

Very truly yours,

Kenneth H Spies

Kenneth H. Spies, Director
Dept. of Environmental Quality

ERL:ch

cc: Federal Water Pollution
Control Administration

PRINCIPAL OFFICIALS OF THE DEPARTMENT OF THE INTERIOR RESPONSIBILE FOR ADMINISTRATION OF THE ACTIVITIES DISCUSSED IN THIS REPORT

	Tenure of office	
	From	To
SECRETARY OF THE INTERIOR:		
Walter J. Hickel	Feb. 1969	Present
Stewart L. Udall	Jan. 1961	Jan. 1969
ASSISTANT SECRETARY FOR WATER QUALITY AND RESEARCH (note a):		
Carl L. Klein	Mar. 1969	Present
Max N. Edwards	Dec. 1967	Feb. 1969
Frank C. Di Luzio	July 1966	Dec. 1967
COMISSIONER, FEDERAL WATER QUALITY ADMINISTRATION (note b):		
David D. Dominick	Mar. 1969	Present
Joe G. Moore, Jr.	Feb. 1968	Mar. 1969
James M. Quigley	Mar. 1966	Jan. 1968

[a] Designated as Assistant Secretary for Water Pollution Control until October 1968.

[b] The Federal Water Quality Administration was transferred from the Department of Health, Education, and Welfare in May 1966.

U.S. GAO, Wash., D.C